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[ILLUSTRATED.]

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Electric Eloquence.

STRIKING UTTERANCES OF A PARTY OF SCIENTIFIC BANQUETERS.

There has appeared at last a daily newspaper reporter who fully grasps the electric situation. At the meeting of the Electric Club, March 3d, the press of the city and the associated press was represented, the *Times*, by H J. W. Dam; the *Tribune*, by C. A. Ransom; the Associated Press, by J. H. Leonard; other members of the press were present. From the various accounts which appeared next morning, we publish one from the *Times*, which is so satisfactory, comprehensive and convincing that every member of the club should feel grateful for its appearance. The article, under the heading given above is as follows:

"Calibrated 'em to a Queen's taste. You just ought to—"

"Thanks; half a volt please."

"Wonderful potentiometer! Perfect daisy!"

"Little o' that stored energy, please, Major."

"Amperemeters, with proportional derivations on the Deprez."

"Bah! Simply applied Cornu's method to the galvanometers! Easy as lying."

"Oh, ho! You just ought to see our cores with 16,000 reversals."

"Not an ohm, sir; not a single ohm, on my honor!"

"Don't tell me, sir! The magnetic lag does not vary."

"Number of watts the same? Of course it was."

"Four-volt cigar, please."

It was the Electric Club dinner at the Union Square Hotel last evening.

The reporter did not speak electric. Only the cheese had strength enough to wrestle with this new language, which has come into English like a colony of Anarchists into Arcadia, and when the dinner was over the Roquefort's odor was entirely gone.

President Davis was in the chair, as nearly as could be ascertained, and the literary proceedings were intensely interesting. As soon as the correlated Java in Bunsen cells was reached, the president, whose unipolagravity was at once a delight and a surprise, cut off the current all around the table by the skillful manipulation of an ordinary knife-handle.

He then introduced Prof. Rudolph Eickemeyer, the celebrated dynamometer of Yonkers, who read a pathetic account of the treatment of an unoffending dynamo by a magnetic circuit to which it appeared to be closely related.

While the professor was being connected with a beautiful low tension circuit, a series of diagrams, consisting of a photographic plan of some Fourth of July fireworks for the Utica Asylum, taken on the spot by a camera in a high state of fever, was passed around.

Confusion being thus restored, the professor told how a young and steady-going armature, with no thought of wrong, had been magnetized by an excited Lelix with more coils than an industrious rattlesnake within the centripetal influence of an annular ring in which, however, an iron shell rotated subject to the self-induction in the coils of a voltameter, whose increased speed, the dynamometer reading remaining the same while the other did as it wickedly pleased, clearly made apparent that the inner and outer lines of force grew smaller and smaller until the armature was surrounded, longitudinally thrown to the ground and put in irons, while the detectives went hither and thither, but failed to detect the least magnetism on the outside.

The ringing applause showed the community interest of all present in the exciting topic, and the pitch to which the professor had, by his simple eloquence, carried them. He began on the second sentence, which it was deemed advisable to keep out of the newspapers, when the steward fell to the floor as if dead. The waiters threw wide the windows, the magnolia on the mantel burst into full bloom, the finger bowls flew down the stairway with a crash, and the gilt eagle on the mantel flapped its wings and said "Hooray" in a raucous tone and vanished.

The meeting adjourned.

Edison in Florida Recovering his Health.

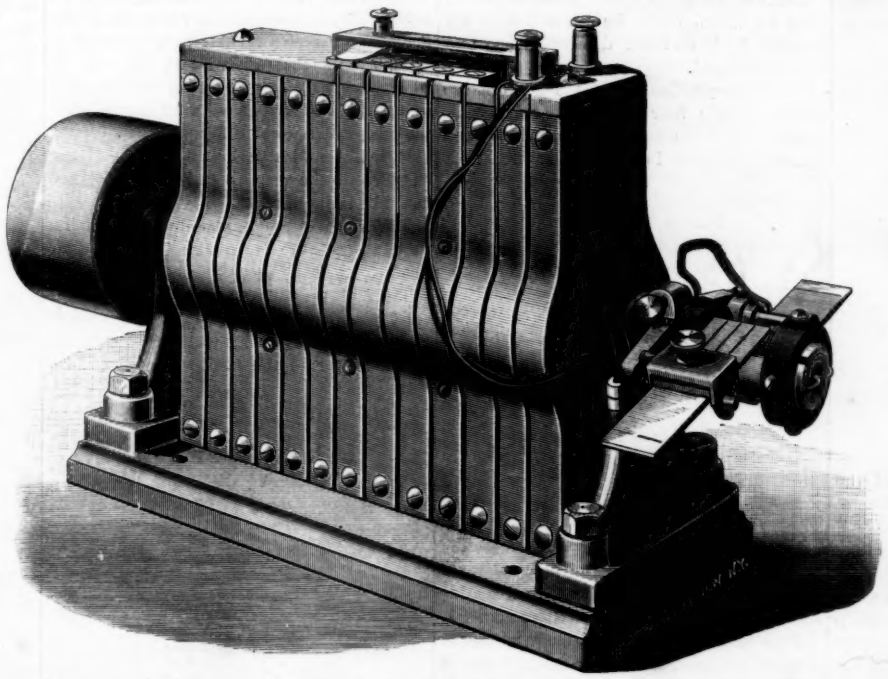
A Jacksonville, Fla., gentleman, in a recent interview, said: "The great inventor Edison is now at his beautiful home at Fort Myers, and though he is still in somewhat feeble health, he is in much better spirits than when he first arrived. The Florida air is having a soothing effect upon his lungs, and he confidently expects soon to be his former self. We heard down there that it was his intention to have come earlier in the season, and that one of his first works was to light the town by electricity, but sickness prevented his earlier arrival, and now this plan, it is thought, will not be carried out at present, as he is devoting his entire energy to perfecting and completing various wonderful inventions. Notwithstanding his feeble health, he has come prepared to work, if one can judge by the number of odd-looking apparatus and machines that are arriving.

"It is amusing to see," continued the gentleman, "with what mysterious awe the negroes regard the electrical wizard. They have picked up from conversation and heard read many wonderful stories of Edison's mysterious and wonderful power with machinery, until they have come to look upon him as something supernatural, and are inclined to give his house and machinery a wide berth. It was difficult to get hands to take his apparatus from the boats. They won't touch any of it, for fear, as they say, 'some ob dem infernal machines gwine to bust.' And then, too, the native whites are almost equally as superstitious, and look upon him as an all-powerful magician.

"Edison is now at work on his electrical railway invention, but devotes a portion of his time to experimenting and working on several other queer-looking machines, the purposes and uses of which I have thus far failed to discover."

Electric Mail Boxes.

The Boston *Herald* says: Yesterday afternoon Postmaster Corse, Assistant Postmaster Dale and Superintendent of Carriers McDonald, of the Boston post-office, spent half an hour in the examination of a newly invented electric mail box. The invention is a very simple one, and the contrivance works something in this way: A letter is left by a carrier in the street box of a business concern. As the letter drops into the box it completes an electric circuit, and the little bell contained in a clock hanging in the inner office of the firm rings, thus announcing the presence of the letter in the outer box. At the same time that the bell notifies the ear of the arrival of the letter in the box without, a little white disc falls across an opening in the case of the clock, thus conveying the same intelligence to the eye. A common electric battery is used, an ordinary eight-day clock employed, and the whole contrivance is very simple. On the one hand, it will immediately notify the occupant of an office several stories above the street, or the occupant of a lofty flat in an apartment hotel, or the busy housewife, of the arrival of the letter, and on the other hand will save the carrier many needless steps and the vexatious delays occasioned by people who will not answer the door bell. Postmaster Corse expressed great interest in the invention, and said that, in his opinion, it would, if generally adopted, effect great economy in the time and force of the letter carriers.



NEW FORM OF DYNAMO, CONSTRUCTED BY RUDOLF EICKEMEYER, OF YONKERS, N. Y.
(*See "Electric Club Meeting."*)

ELECTRIC CLUB MEETING.

Mr. Rudolf Eickemeyer's Interesting Experiments, and His New Dynamo Electric Machine.

THE DISCUSSION WHICH FOLLOWED.

The monthly meetings of this new and remarkably active and progressive Club are becoming more and more attractive and beneficial to the electrical fraternity, and at none has there been presented a more interesting or original paper than the one read by Mr. Rudolf Eickemeyer at the meeting held March 3d. There was the usual large attendance, and thirty-two new members were elected. The tables were conveniently and tastefully arranged for the dinner, and after it was enjoyed, amendments to the constitution and by-laws were adopted; a nominating committee to report names of officers for the ensuing year, to the nominating meeting of the club to be held March 21st, was appointed by the chair, consisting of Messrs. Candee, Stanley, Dutton, Field and Reed.

Mr. Rudolf Eickemeyer was introduced by the president, and read the following paper, entitled "Some Remarks On the Magnetic Circuit in Its Relation to a New Type of Dynamo Electric Machine:"

At the meeting of the National Electrical Conference at Philadelphia, on Sept. 11, 1884, Prof. H A. Rowland gave the following reasons as the causes of the loss of electrical energy in dynamo electric machines (*Electrical Engineer*, October, 1884, page 218):

1. Mechanical friction.
2. Foucault currents.
3. The current used in sustaining the magnets.
4. The heating effects in the revolving coil.
5. The production of self-induction in the coil.

Under the third cause, he is reported to have suggested several possible causes of loss of power, such as:

1. The use of wrought iron in place of steel in the magnets.
2. The elongated shapes of the cross sections of the magnets, in some of the forms.
3. Especially the duplication and multiplication of magnets.

The form of the poles of the magnets was also a possible cause of loss of energy, and showed how, in several forms of machines, leakage of magnetic force would occur.

His deductions were:

1. That magnets of a perfect dynamo must be circular in section, of one pair of holes, and perhaps of steel.
2. The poles should be of large size approaching closely to the armature
3. That opportunities of leakage should be avoided as much as possible.

Prof. Elihu Thompson stated that he did not believe that extension of the poles of the magnet would be followed by a gain, since

loss by radiation into the air would be inevitable.

Neither did he see the objection to having a double magnet with the poles jointed and he armature in the center.

Mr. N. G. Keith did not agree with Prof. Rowland in regard to single magnets; but preferred the form in which the poles were jointed and the armature revolving about the mutual axis,

Prof. Sylvanus P. Thompson did not agree with Prof. Rowland as to cylindrical magnets being invariably the best form, and pointed out the defects where several cylindrical magnets were jointed upon one pole.

The report closes with the statement that Prof. Forbes made an explanation reconciling the discordant results.

A series of experiments suggested themselves to the writer while experimenting with unipolar machines, which seemed to throw some light on the questions raised in the discussion above referred to, and the experiments and directions drawn from them are herewith presented.

The figures used have been prepared specially to illustrate the various experiments, and to present the steps taken to verify the conclusions.

When a soft iron ring is wound with an insulated copper wire and the copper wire is put in circuit with a battery, a magnetic current is produced which gives no external evidence of its existence.

There are no poles, and no lines of force can be seen when iron filings are sprinkled on a card-board above it; yet if a secondary wire is put over the primary and the primary is broken, an induced current is produced, the same as if a straight magnetic bar of iron had been used.

If, however, the iron ring is cut open at any point the poles and lines of force appear at once.

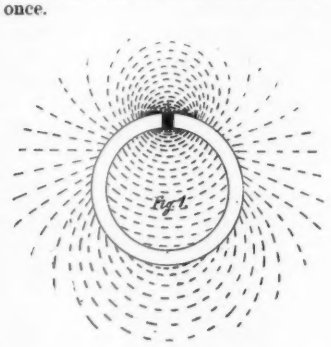


Fig. 1 represents the appearance of the lines of force when such a ring is cut open at one point and some of the iron removed.

Two centers appear, around which the lines of force bend from side to side. At the point where the ring is cut the filings pile up and the curves connecting the two ends are sharp and well defined. Less distinct curves appear at the point directly opposite the opening where the lines of force run from side to side and around that point.

The removal of a portion of the ring has developed two poles and a magnetic field of force.

The lines of force are most dense between the two faces and the portion of the iron near the ends, and become less and less well defined as they start nearer to what is called the "neutral point" in the magnet.

The field of force thus produced can be used in an electric generator or electric motor. And all those lines of force which pass through the armature, and no doubt represent the largest portion of the magnetic current, are cut by the armature when rotated.

That portion of the magnetic current is wasted, however, which is indicated by those lines which complete their circuit outside of the armature, or, as it is termed, scattered.

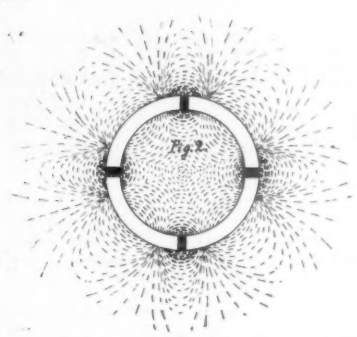
The simplest form of an electric generator or motor is the copper disk used by Faraday in his experiments.

The disk when rotated between the two ends of the iron ring produces a current which flows from its axis to the periphery, thus furnishing a simple means of testing the value of the field of force.

The magnetic circuit in this case is formed by the magnet and armature, and the magnetic current in the machine passes through the iron ring and the armature.

Now, if the iron be cut at any other point the magnetic circuit would again be broken and a new field of force would be the result.

The magnetic current would again flow from end to end at the new opening, continue its passage through the iron to the next opening, and so on to complete its circuit.



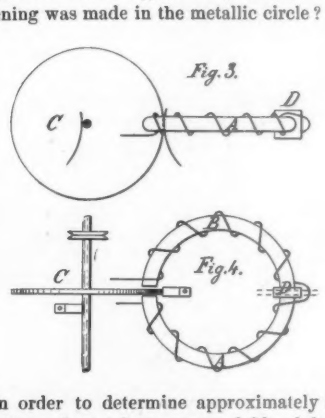
In Fig. 2 is shown a ring exactly like Fig. 1, but cut at four points.

The figure shows that the filings now pile up at four points above the four cuts, forming four centers around which the lines of force bend.

Midway between the segments are four more centers of other curves, which complete their circuit from the end of each segment to the other end of the same segment, and do not pass from one segment to another.

Four fields of force are here produced, each of which could be utilized like the original field, and the density of any two should be equal.

Now, the question is, what is the relative value of these four fields of force as compared with the original one, when but one opening was made in the metallic circle?



In order to determine approximately the relative values of one or two fields of force in the same magnetic circuit, the machine shown in Figs. 3 and 4 was constructed.

Two semi-circular electro-magnets *A* and B were so arranged upon a support that a disk *C* could be freely rotated between their two faces.

In the first experiment a copper disk with suitable brushes was rotated between the faces of the magnet, while the opening between the magnet at the other end was closed with a piece of soft iron *D*, nicely fitted and somewhat larger than the faces of the magnet ends.

The magnetic circuit was thus closed, except at the point where the disk was inserted and the lines of force, as seen when examined by means of iron filings, showed by a slight accumulation on the two sides of the piece *D* that the magnet was not continuous. Yet on the whole the figure produced had the characteristics of Fig. 1.

The rotation of the disk when the helix was excited produced a deflection of 19° in an ordinary tangent galvanometer with a fine coil.

D was then removed while all other conditions remained as before. The galvometer showed a deflection of 14°.

The loss of energy thus indicated was due to a second opening in the magnetic circuit.

In this experiment a copper disk had been used.

In order to reduce the resistance of the magnetic current an iron disk of the same size as the copper one was now put in the machine.

When the piece of iron *D*, which connected the magnets at the second opening was put in place, and the disk rotated, the galvanometer now showed a deflection of 33°.

D was now taken out and another of the exact thickness of the iron disk was put in the second opening, and insulated from the faces by pasteboard equal in thickness to the space between the disk and the magnet faces.

In this condition the galvanometer recorded a deflection of 24°, and when all the iron was removed 19°.

The use of the iron disk had increased the deflections of the galvanometer from 19° to 33° when the magnetic circuit was completed by the block of iron *D*.

It had increased the deflections from 14° to 19° when the block of iron was removed; and when a piece of iron of the thickness of the iron disk was inserted in the second opening and insulated with pasteboard, the current produced by the rotation of the iron disk deflected the galvanometer 24° or 25° more than that produced by the copper disk when the magnetic circuit was completed by the block of iron *D*.

The iron disk had demonstrated that by its use each of the two fields of force could furnish a current equal at least to that produced by the copper disk.

The action of the iron disk in the experiment was, no doubt, due to the fact that its introduction in the field of force had reduced the resistance to the magnetic current at least one-half.

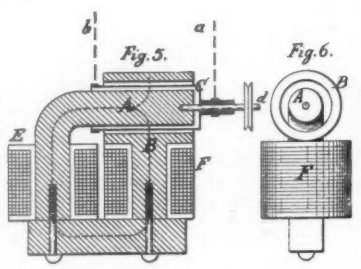
It is clear that the four fields of force in the ring, Fig. 2, could be made equal to the field in Fig. 1, provided the resistance to the magnetic current was sufficiently reduced.

To reduce the resistance in the field of force was the next problem, and a great number of experiments were made with unipolar machines of different types.

It was found that by an increase of the surfaces of the magnet ends, the resistance could be reduced.

Fig. 4 represents a machine in which a tubular armature is rotated in an annular field.

The hollow cylinder which surrounds the solid core was lengthened until a copper tube produced a current which deflected the galvanometer to the same extent as an iron tube.

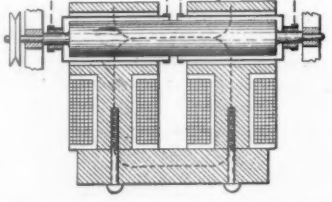


The machine is shown in longitudinal cross-section in Fig. 5, and Fig. 6 is an end view with the armature removed.

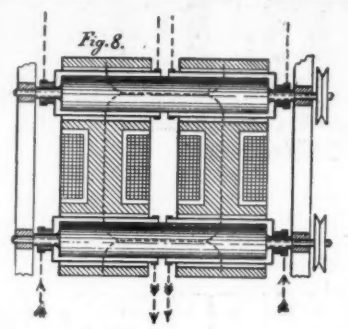
A is the solid cylindrical end of the electro-magnet, and *B* the other end.

The latter is a hollow cylinder which surrounds the core *A*, concentrically, leaving an annular space between the two, which forms the field of force in which the armature is rotated. *C* is a tube mounted upon, but insulated from the driving shaft *d*.

Brushes to take off the current were placed at *a* and *b*. The solenoids *E F* served to excite the magnet.



After this model machine had been perfected, two more machines, Figs. 7 and 8, of the same type were made. One had two fields of force, the other four.



The electro-magnets were made of the same cross-section, the same quantity of insulated copper wire was used in each of the machines, and the same tubular armatures were used in each case.

The result of a great number of experiments seemed to show conclusively that the magnetic circuit could be cut four times at least, and each cut produce a field of force equal in density to that when cut but once.

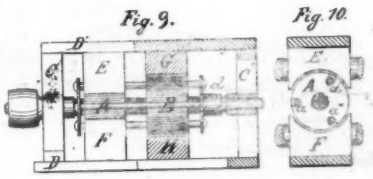
The magnetic circuit in the first instance was longitudinally through the electro-magnet and the annular field of force where the current passed from face to face.

In the second machine the current had to pass through air spaces twice and in the last one four times, and yet in each of the fields the armature produced the same current.

When two or four armatures were used in the machines each of the armatures produced a current substantially equal to that produced by the armature in the first case.

In the last machine four armatures were really excited by the same current and by the same helices which had been used in the first machine, and the electric energy used in the first case to produce one field of force now furnished four.

To test the same question, in another way, a model of a bipolar machine with heavy iron armature cores and with four cheek pieces was made.



The machine was constructed as in Figs. 9 and 10.

Two heavy rings of soft iron *A* and *B* were mounted upon a brass shaft, which had its bearings in two brass frames *C* and *C'* connected by bottom and top plates *D* and *D'* of brass.

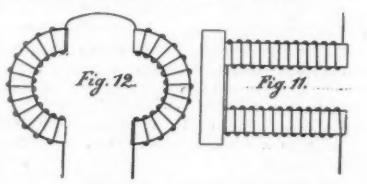
To the two plates four cheek pieces *E F G* and *H* were secured.

Each ring had two cheek pieces, one above and one below which closely fitted the rings.

Each cheek piece covered about one-third of the armature, leaving about one-sixth on each side uncovered.

Three copper rods *a a'* and *a''* were put in the grooves equidistant from each other and close to the circumference of the rings.

All three were connected on one side by a copper flange and on the other to three commutator plates at *d*, from which the current was taken by means of two brushes.



An electro-magnet made of two bars of round iron with insulated wire wound upon them, and connected by cross-bars, Fig. 11, were secured upon two of the cheeks *E* and *F*.

The machine was then set in motion.

The current produced caused a deflection of 30° in a tangent galvanometer.

Two bars of wrought-iron of the same size and length were next bent in semi-circular form as shown in Fig. 12, and wound with an equal quantity of wire; and

the two horseshoe magnets thus obtained were put on the cheeks of the machine.

One of the magnets connected the lower cheek *F* of the first armature ring with the upper cheek *G* of the armature ring *B* in the rear; while the other horseshoe magnet connected the upper cheek *E* with the lower cheek *H* of the armature ring *B* in front.

The magnetic circuit thus obtained was as follows:

Suppose the magnetic current passed from cheek *F* into the armature *A*, through *A* to the cheek *E*. It would then pass through the horseshoe magnet which connects the cheek piece *E* with the cheek piece *H* and through the armature core *B* to the cheek piece *G*, then complete its circuit through the other electro-magnet to the cheek piece *F*.

The cheek pieces *F* and *H* were of one denomination and the cheek pieces *E* and *G* of the opposite.

The machine as constructed had a magnetic circuit substantially like the unipolar machine illustrated in Fig. 8, in which the armature core *A* forms the cross-bar for the armature core *B* and *vice versa*.

The armature core *A* in the present machine acted as the cross-bar for *B*, and *B* as the cross-bar for *A*, or the one completed the magnetic circuit for the other.

The deflection caused by the current produced in this device, everything else remaining the same, exciting currents, speed, etc. was 43°. Or if we compare the tangents of the angles of deflection the strengths of the currents were in proportion as .57 to .93.

The machine had evidently been improved by this alteration.

Each conductor cut the magnetic current at the two cheek pieces *F* and *H* and also at the cheek pieces *E* and *G*, and the currents produced were added in the conductor.

The machine had really two armatures *A* and *B*, each rotating in a field of force of its own.

Both fields of force were, however, in the same magnetic circuit, and the conductor cut the same lines of force four times during each revolution. Once between *F* and *A*, again between *A* and *E*, again between *H* and *B*, and also between *B* and *G*, substantially as in the arrangement shown in the unipolar machine, Fig. 7.

But while in the unipolar machine the four armatures were operated independently of each other, the two armatures in the present machine were mounted on one shaft and rotated together.

Now the conductor being in one piece and the cheek pieces one each side of like denomination, the armatures were in series and the currents produced were therefore added.

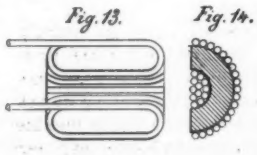
Taken in connection with the experiments with the unipolar machines this seemed to prove that a magnetic circuit could be cut any number of times and fields of force for the generation of currents produced, provided the resistance in the field of force is no greater than in other parts of the circuit.

The question now presented itself in this way:

Was the improvement due to the fact that each conductor passed through the same magnetic circuit twice in each revolution? Or was it due to the fact that two electro-magnets, each of the same cross-section as the first, were used?

To determine this question, a new electro-magnet was made and applied to the cheeks, and the experiments repeated.

Fig. 13. *Fig. 14.*



The electro-magnet is shown in front view in Fig. 13, and in vertical cross-section in Fig. 14.

It consists of a bar of wrought-iron, wide enough to reach over two cheek pieces, and bent in horseshoe shape, as shown in Fig. 14.

This bar was again wound with the same quantity and size of wire as the two horseshoe magnets and the bar magnet used in the previous experiments.

Under the same conditions as were the preceding experiments, the machine furnished a current which deflected the tangent galvanometer to 45°, or 2° more than the one with two magnets.

Many other alterations were made.

The same quantity and length of wire was wound upon four curved bars, and these connected to the cheek pieces. And finally two broad magnets, like the one shown in Figs. 13 and 14, each wound with one-half the quantity and length of wire, and placed on both sides of the machine, were tried.

All the experiments had been made under precisely similar conditions, viz.: the same quantity and length of wire in the electro-magnets, the same exciting currents in the electro-magnets and the armature revolving at the same speed.

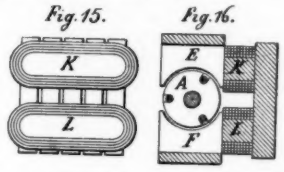
The currents produced deflected the galvanometer as follows:

One magnet, Fig. 11, 30°, tang. = ...0.5774
Two magnets, " 12, 43°, " = ...0.9325
One broad magnet, Figs. 13 & 14, 45°,
tangent = ...1.00
Two broad magnets, Figs. 13 & 14, 62°,
= tangent. 1.8807

Step by step, as the cross-section of the electro-magnets had been increased and the resistance in the magnetic circuit reduced, the machine had been improved.

The electro-magnet has been shortened in each instance, and its cross section increased. It seemed as if this process could be carried on indefinitely, and it was therefore decided to experiment in another direction.

Fig. 15. *Fig. 16.*



Two cross-bars *K* and *L* of wrought-iron were secured upon two cheek pieces, as shown in side view, Fig. 15, and in vertical cross-section, Fig. 16.

Each bar was surrounded by a helix, as at *K'* and *L'*.

The same quantity of wire as in all previous experiments were used in the coils, and the cross section of the bars *K* and *L* was equal to the cross-section of the broad magnet, shown in Figs. 13 and 14.

Suitable bars of iron *M* were provided to connect *K* and *L*, and thus completed the magnetic circuit.

When the magnets were excited as before, and the pieces of iron *M M* had the same or a greater cross-section than *K* and *L*, the current produced by the armature deflected the galvanometer to the same extent that it was deflected when the broad magnet, Figs 13 and 14, was used.

By the removal of some of the bars the magnetic circuit could be gradually reduced, and the resulting change in the current was about as follows:

If the whole cross-section of the electro-magnet be 100, and the current value, when the full cross-section of the magnet is used, be also called 100, then the cross-section bore about the following proportions to the current:

Cross-section.	*Current.*
100	100
70	80
33	52
22	37
15	25
7½	11

These figures seem to indicate that the current does not bear the exact proportions of the cross-section of the magnetic circuit.

As the cross-section of the iron was reduced, its relative value as a conductor of the magnetic current seemed to increase.

An increase probably due to the fact that a greater part of the magnet current completed its circuit through space, than when the whole current was carried by the metal.

It seemed evident that the value of the magnetic circuit is equal to that portion which offers the greatest resistance to the magnetic current, and that the magnetization of the point of highest resistance is the true measure of the efficiency of the machine.

In all dynamo machines that point is where the magnetic current passes through space from the cheek pieces to the armature core; or when an armature without magnetic metal is used, where the magnetic current passes from one cheek piece to the other.

Taking all these points into account, the question presented itself like this:

How to construct a magnetic circuit of the least resistance, with the least liability to scatter, and so constructed that the magnetizing effect of the exciting helix is made to surround magnetic material of the largest cross-section in the machine.

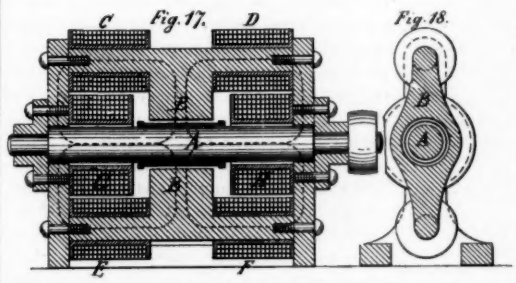
The experiments with unipolar machines referred to before seemed to furnish a number of points to answer this question.

While experimenting with unipolar machines, an experiment was made with a machine shown in Figs. 17 and 18.

A core of wrought-iron *A*, which acted as the armature core, was surrounded by a cylindrical cheek piece *B*. The machine had six coils *C D E F G* and *H*.

The first four coils had exactly the same quantity of insulated wire as the two last ones, but the value of the machine as a generator was nearly doubled when the two coils on the armature were used to excite it than when the four coils were used.

Fig. 17. *Fig. 18.*



In the one case the armature core was magnetized by the electric current directly, while in the other case, it was magnetized by magnetic induction from the cylindrical cheek *B*.

This experiment and various others seemed to prove that there is a loss of energy when the core of the armature is polarized by magnetic induction, and that the best results can only be obtained in unipolar machines, at any rate, when the armature core is magnetized by the exciting helix directly.

Another set of experiments had demonstrated another point.

When a conductor is rotated around the end of a magnet, a current is produced which may be taken off by means of brushes. Fig. 19 is an illustration of such a device.

The magnet core *A* is surrounded on one end by a helix *B* by means of which it is magnetized. An armature *C* surrounds the projecting end of the core. If the armature *C* is rotated a current is produced.

The magnetic current which in this case passes through the iron has to complete its circuit through space.

Fig. 19.

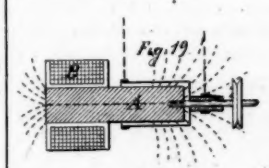
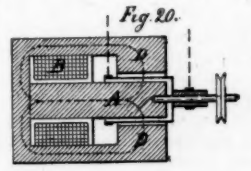


Fig. 20.



In Fig. 20 the same magnet core, exciting helix and armature are shown, but the whole is inclosed in a shell of iron *D*.

This shell *D* furnishes a metallic conductor for the magnetic current, and reduces the air space through which the magnetic current has to pass to a minimum.

The core *A* is surrounded by the hollow annular shell *D*, and the air space is reduced to an annular ring in which the armature is rotated.

The relative values of the two devices are almost as 1 to 2.

In the first instance the great resistance in the magnetic circuit caused scattering of the lines of force into space, while in the second device none or but very little external magnetism appeared.

These experiments seemed to demonstrate that the best results were produced in unipolar machines when the exciting coil surrounded and magnetized the armature core, and second, when the armature core and helix were completely enclosed in a shell of iron.

It seemed but reasonable to suppose that the same favorable results should accrue if these principles were followed in the construction of bipolar or other multipolar machines.

The problem presented itself in this form:

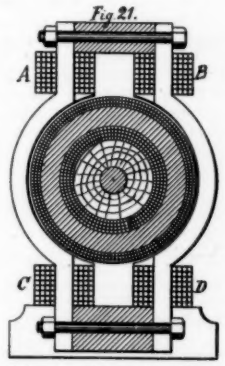
How to construct the magnetic circuit of a bipolar dynamo machine, which would have the greatest cross-section throughout and be so short that it could not be cut again?

Construct an exciting helix which would magnetize the armature directly, and a shell which, while it surrounded both armature and coils, would complete the magnetic circuit?

A number of small machines were made, in which the exciting helix surrounded the armature core; both housed in iron shells, and their efficiency tested and compared with machines of the common type of the same size.

But in order to test the relative values of the two methods it was finally decided to construct a machine which could be readily changed from the common method to the new. The machine was tested under precisely similar conditions, first with four common coils which excited the electro-magnets and afterwards with four coils which surrounded the armature.

Fig. 21.

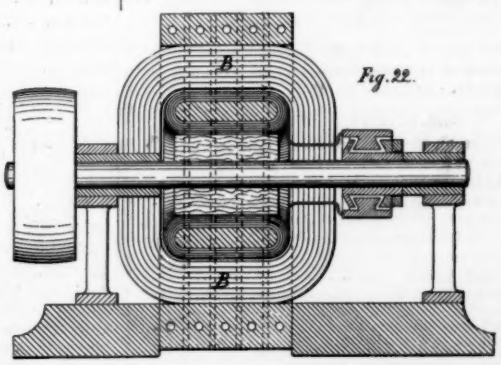


The machine is shown in Figs. 21, 22, 23 and 24.

A ring armature 8″ diameter, 6″ long, wound in 64 sections fitted into a frame as shown in section Fig. 21.

The electro-magnets were of the Siemens type, made of soft iron bars and each set of bars, five on each side, were wound with 60 pounds of No. 7 *B* and *S* gauge, double insulated wire in four spools as at *A B C D*.

Fig. 22.



The machine was now thoroughly tested as a series machine.

After this test four other helices were substituted for the first, as shown in Figs. 22 and 23 at *B B*.

(*Continued on page* 8.)

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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NEW YORK, MARCH 12, 1887.

CONTENTS.

	PAGE
Electric Eloquence	1
Edison in Florida Recovering his Health	1
Electric Mail Boxes	1
Electric Club Meeting—Mr. Rudolf Eickemeyer's Interesting Experiments—His New Dynamo-Electric Machine	1, 2, 3, 8, 9
A Victory for Gaulard and Gibbs	4
The Dynamo Experiments of Mr. Rudolf Eickemeyer	4
Chicago Electrical News	5
Practical Information	5
Queries and Answers	5
Telephonic News	6
An Electric Feeder	6
Could Not Have been Special Agent Knight	6
The Electric Club of New York	6
A Strange Meteorological Occurrence in Venezuela—Official's Account	6
The Two Subway Bills of New York	6
Brooklyn Subway	6
An English Expert's Scheme to Use Electricity in Warfare	7
Boulanger Discovered	7
Our Rochester Letter	7
Telegraphic	7
Mining by Electric Light	9
That Edison Decision in England	9
Electric Light News	9
Electrical Patents	10

A new form of baton has been developed by the last comic opera of Gilbert and Sullivan. Sir Arthur personally directed the orchestra at the Savoy theatre, and in a night scene, that his baton might the better be followed, its upper extremity was decorated with a small incandescent lamp.

Accumulators and converters are leading topics in electrical circles.

Suppose the price of carbon pencils should be greatly increased, what a marked diminishing effect it would have on the revenue of electric lighting companies.

It is estimated that there will be 1,200,000 soldered connections in the new Cortlandt street exchange of the Metropolitan Telephone Company, of New York, where provisions are to be made for 6,000 subscribers, with a possible extension to 10,000. Estimating the cost at one cent (a low estimate), per connection, the neat little sum of $12,000 will be required for this item alone. Yet the public think there is no expense connected with the maintenance of a "box on the wall."

Something has been said of late regarding the wire of a dynamo receiving a static charge and acting like a Leyden jar. Probably interruptions in the circuit have less to do with this than belt friction. The suggestion to connect the frame of all dynamos with the ground does not seem to be advisable, for in case there be a leak from the commutator, brushes, armature or field magnet coils to the iron fields or base, a second ground on the line wire would cause serious damage.

Never before was there such a demand for improved methods of heating and lighting railway cars, and so many ready with systems to do both of these things. The report of the Railroad Commissioners on the Vermont accident is emphatic in its condemnation of stoves and oil lamps. Primary batteries, storage batteries, directly connected dynamos have been urged as sources of electricity for incandescent lamps. Of the methods proposed for heating but little has been said of electrical means, because of the great expense and increased size of plant needed.

The most complete and valuable published list of the electric lighting fraternity and kindred interests of the United States was the one published by the ELECTRICAL REVIEW in its issue of February 26.

It comprised a carefully prepared catalogue of the names, addresses, and business connections of all attendants at the National Electric Light Convention in Philadelphia, February 15th to 17th, and it was most favorably received, if the large demand for extra issues of this journal is to be taken as an indication of what was desired.

An opportunity is offered. A commission of French scientists has been named by the Minister of Public Instruction, whose duty will be to offer a prize of $10,000 to the discoverer or inventor of that method which will result in the greatest progress in electrical advance in heating, lighting, chemical action, mechanical power, transmission of dispatches or the treatment of disease.

The gentlemen composing the commission are: Messrs. Bertrand, Allard, Becquerel, Berger, Brown-Sequard, Cornu, Debray, Deprez, Joubert, Turien de la Graviere, Levy, G. Lippmann, Herve-Mangon, Marey, Mascart, Paris, Raynaud, Sartiaux and Vulpian.

One of the most difficult pieces of territory whereon to erect a telegraph or telephone line would seem at first thought to be across the Alps. With a St. Augustine canon of the Catholic church who directs the movements of the men of the Hospice of Saint Bernard, there can be no such word as fail. Amid the fearful whirlwinds of snow which almost constantly circle through the mountains, often accompanied by the fiercest displays of nature's fireworks, Canon Burgeois has inaugurated a telephone connection between the greater and lesser Saints Bernard, the canton of Proz, the little borough of Saint Pierre, Canton Fontinte, and Saint Chemy. The altitudes of the first two mentioned Saints are respectively 8,150 and 7,076 feet above the sea. The Saint Bernard year is made up of 9 months of zero weather and 90 days too cold for tobogganing. No wonder the good old canon wanted to talk to somebody—even by telephone. At last accounts the wires were being pushed on to Rome.

The REVIEW of February 26, 1887, was generally acknowledged to be the most complete and instructive issue of an electrical journal that ever appeared.

Country papers, bless their innocence, are copying that mouldy old April fool yarn of years ago, which some one has resurrected, about Edison's wonderful discovery of how to turn everything into something to eat.

If in the next decade or two that sublime eminence where perfect knowledge and understanding of electricity shall have been attained, it is among the possibilities that Electrician Slattery's definition of electricity will have to be reconstructed, or at least added to.

Probably the most technical discussion of the past year was the one that occurred at the last Electric Club meeting in this city, and as an indication of the rapid spread of electrical information, a New York reporter was discovered fully equipped with that peculiar and recondite knowledge that enabled him to successfully present the work of the meeting so that the most careless reader could understand. In proof of this, one has only to read the article from the *Times* on the first page of this issue.

Prof. W. F. Barrett, at a recent meeting of the Dublin Royal Society, detailed some of the remarkable properties of steel containing 12 to 14 per cent. of manganese.

It is almost dia-magnetic, and its electrical conductibility is extremely feeble. The manufacturers of the samples shown are Hadfield & Co., Sheffield, and Prof. Barrett is authority for the statement that both tempered and soft steel wire may be made as fine as .98 millimeters. Its electric resistance is about one ohm per meter. Specific resistance C. G. S. 77,000, ordinary iron, 9,800, and German silver, 21,170 C. G. S. units.

Prof. Barrett is of the opinion that this form of steel is especially available for resistance coils, particularly for electric lighting installations.

After having submitted specimens to the most powerful magnetic field, Mr. J. J. Bottomly found its magnetic intensity equal to 2.55 C. G. S. units; in other words, 0.013 C. G. S. units per gramme. With ordinary steel similarly treated 40 to 90 or even 100 C. G. S. units would not be extraordinary magnetization. Thus, while ordinary steel would show a result of 100,000, the manganese steel (l'acier manganique) would exhibit only 20.

Prof. Barrett suggests the use of this compound metal for dynamo frames and for plating for vessels. The feeble magnetism of the metal would work little or no disturbance of the needle.

The tempered wire of 0.98 millimetres has a tensile strength of 110 tons per square inch, and 173.5 kilogrammes per square millimeter. Ordinary steel has only 80 to 100. Piano wire steel alone has a greater tenacity than the manganese steel.

A VICTORY FOR GAULARD AND GIBBS.

We understand that the trial brought between the owners of the French patents, Gaulard and Gibbs and MM. Zipernowsky, Deri and Blathy, after having been determined previously at Tours in favor of the first inventors, has just been brought before the Court of Appeals at Orleans.

This Court, we are told, has condemned MM. Zipernosky, Deri and Blathy to deposit in the bank of consignments during a term of two weeks, to date from the judgment, the sum of 30,000 francs, independent of the payment made at Tours, and to pay the expense of the first deposit of the sum of 30,000 francs.

Besides, the International Company of Electric Lighting, owner of the patents of Gaulard and Gibbs, are authorized by the tribunal to demand of MM. Zipernowsky, Deri and Blathy any sum which should seem necessary during the proceedings which will follow." This looks as though Gaulard and Gibbs had the floor at present and that some one else might have to pay the fiddler.

THE DYNAMO EXPERIMENTS OF MR. RUDOLF EICKEMEYER.

It is with much pleasure that we refer to the admirable paper by Mr. Eickemeyer, before the Electric Club of this city at its last meeting. Seldom has that organization been privileged to listen to the recital of more original investigation. Not often have its members enjoyed the intellectual pleasure of following so orderly an arrangement of thought, so admirably expressed, and so beautifully illustrated by the inventor's own drawings, copies of which were placed in the hands of all the gentlemen present, for reference. Much of the charm of the occasion was due to the atmosphere of quiet enthusiasm which surrounded the speaker, and the parenthetical words of explanation, which, of course, do not appear in the printed address, to be found in another column.

The early portion of the paper, although devoted to familiar facts in the disposition of lines of force from annular magnets, yet led the minds of the listeners up to subsequent deductions, which struck those present as possessing considerable novelty and merit. It was, perhaps, unfortunate that, in referring to the changes in the strength of currents in the various experiments, the speaker referred to them in deflections of a tangent galvanometer; first, because it is difficult therefrom to form any mental conception of the real strength of the currents represented by the deflections, and secondly, because the very name of "tangent galvanometer" inspires a want of confidence in the accuracy of the determinations, where strength of induced currents and lines of magnetic force are anywhere in the proximity of the instrument.

Supposing the readings on the tangent galvanometer to have been uninfluenced by extrinsic causes, the strength of the induced current in the case of Figs. 3 and 4 would have been as follows. When the piece of soft iron [D] was in place, and when it was removed, and the magnetic current was obliged to act through the air, the strength of the induced currents in the copper disk were as 3443 : 2493, or about 27 per cent. less upon the removal of the piece of soft iron [D]. Again when the copper disk (see Fig. 4) was replaced with one of soft iron (the soft iron D being in place) the ratio was as 6494 : 3443 or about 46 per cent. less with the copper disk than with the soft iron disk. Again, by replacing the soft iron block [D] with an iron disk insulated from the pole pieces of the magnets by pasteboard, the loss of current was about 28 per cent.

These figures are vastly interesting, from the fact that they show us that it is not safe to rely in practice upon the theorem long ago propounded by Faraday, that all the lines of force emanating from a magnet (of constant moment) would be the same in quantity, no matter if the magnet be a single bar of iron, or cut up into several short magnets. Referring to this very question the author above aluded to makes use of the following words: "A point equally important to the definition of these lines is, that they represent a determinate and unchanging amount of force. Though, therefore, their forms as they exist between two or more centers or sources of magnetic power may vary very greatly, and also the space through which they may be traced, yet the sum of power contained in any one section of a given portion of the lines is exactly equal to the sum of power in any other section of the same lines, however altered in form, or however convergent or divergent they may be at the second place."

The thanks of the REVIEW are heartily tendered to Mr. Eickemeyer for his kindness in making public the results of his practical investigations in this interesting line of research, and the wish is here made that his labors, which are as yet only begun, may bear fruit in the practical improvement in dynamo machines.

Just as the movement to bury the wires in this country looks hopeful, news comes that the Poles mean to rise in case of a war between Russia and Austria.—*Ex.*

CHICAGO ELECTRICAL NEWS.

Every now and then somebody says something about the tricks and ways of the bucket shop people, in getting around the best laid schemes of the telegraph folks, to keep the quotations where they will do the most good in the way of reward or remuneration.

The matter came up the other day incidentally in conversation with an agent of a market quotation company, on hearing of the death of an old operator, and he related a very interesting anecdote in that line.

Underneath the old Board of Trade building there is a low, dirty sub-cellar, which scarce any one ever has occasion to light up with a candle. To reach this it is necessary to go through the floor.

There was some occasion for canvassing the how to get into the old building a year or so ago, and after considerable skirmishing, this party, who was an employe of the company, said he knew of a way, if that was all that was wanted. He had been there before. Years ago he was employed by a bucket shop concern, and he had driven a pipe into that sub-cellar, and got a connection with a telegraph line which was available for several months.

"How did I get there? Why, of course, I didn't drive it by pounding. I'm no chump. I forced it through with a jack screw, and during the skirmishing and hunting the electric sharps were engaged in, I was quietly getting my reports 'alle same.'"

He has gone the way of all flesh, and the irreverent poet suggests an epitaph:

The bucket shop man now the bucket has kicked,
Death couldn't have whooped him up quicker;
No longer he steals from the sounder that clicked,
Nor furnishes tips for the ticker.

Under date of Feb. 28th a special from New Orleans refers to the fire which destroyed the shot-tower of the Gulf Shot and Lead Company, and states that suit had been entered by that company against the Brush Electric Light Company for $7,100 damages resulting from the electric light wires, which it is claimed produced the conflagration.

A gentleman who was in Chicago a few days since, expressed the opinion that this assertion would be a very difficult one to maintain, as he said he had seen parties who knew the wires were not in connection with the generator when the fire took place. We shall see.

On the last day of February, the Fire and Water Committee passed favorably upon the ordinance for lighting the river and bridges with electricity, and advised an appropriation of $75,000 for that purpose. Now, when the council do this—if they ever do—and the electric light people find it out—and they never will—what a burden somebody who listens will find his life has grown to be.

Our State Legislature seems to be unhappy save when it has a chance to nibble the ears of some corporation; and the chewing gum which seems the most satisfactory is that which has lightning as a basic constituent.

Senator Baker the other day introduced a bill compelling telegraph companies to make annual reports of the business to the State Auditor, and providing for taxing the same. This is the 'steenth time this matter has been raked up, but somehow or other each time up comes a "conscience qualms quieter" and prevents it from ever getting on the statute books.

Something like half a dozen telephone "regulator, ready relief, and resolvent" bills have been offered. The cunningest little bijou of the batch is that of Senator Bacon, of Edgar, who wants telephone charges limited to $25 per annum in all cities of more than 10,000 inhabitants. The bill was referred on the 3d instant to a subcommittee consisting of the paternal author of the "hindering little thing," with Messrs Johnson and Organ. About the same time a bill was introduced prohibiting marriages by proxy, or when either person has been indicted for or convicted of a felony, as well as marriage by telegraph, telephone or letter, or when the persons are disguised. Thus are we cut off from the privileges of freemen by the hot-headed anarchists' inane performances. Pretty state of things, this. Next we shall hear that the Legislature will interfere to prevent our saying sweet things to the damsel we only know by number, who so readily connects our telephone wire with the wrong party, and innocently informs us that we called for the strange person, and does other little acts of kindness to aid us on our travels through this vale of tears. When it comes to that—and it certainly will if things go on thus—when we are not permitted to say soft flattering things to the gay, giddy, laughing unknown, then, even at $25 per year, a telephone will not be worth having—life would hardly be worth the living.

Rather an amusing anecdote in the telephone way is this, from a daily reporter, showing how the true heroic mother neglects no precautions for the welfare of her little ones:

A touching case is related of a wealthy, well-educated, and fashionable woman who resides in a handsome home on one of the aristocratic South Side avenues. The woman's sister is sick in Europe, and preparatory to going to her side she was searching for a reliable housekeeper who could be depended upon to take the best of care of her two children. A visitor mentioned just the sort of person desired; but added that the housekeeper was now domiciled in a household where two children were just recovering from a slight attack of scarlet fever.

"Well," murmured the South Side woman, "I suppose there wouldn't be much danger if all her clothes were burned and her hair fumigated."

"No," responded the visitor, "and you could call her up by telephone and arrange with her about coming."

The woman was at first aghast at the proposition, and was sure that there would be great danger of infection over the wire; but finally was convinced by the arguments of her friend, and concluded the conversation by saying:

"Well, I suppose I must risk it. I'll have a servant call up the house and tell them be sure that the housekeeper changes her clothes and the sick children aren't in the room where the telephone is; then I may feel justified under the circumstances in talking with her. Good-by, I'm very much obliged for your suggestion."

Away up northwest of us the people are having one of those terms of extremely-late-in-the-fall springs we have heard about. On the Winona and St. Peter Railroad, between Mankato and Tracy the snow drifts are six feet above the telegraph poles, and linemen have had to run up scantling topmasts to get the wires up where they could be used.

Some of the drifts are 25 feet deep and so solid the company dares not try the snow plow on them. Market gardeners are discouraged. They haven't even a fence to sit on while the spring is opening.

The anticipated result of the telephone question in Ontario has been reached. The Canada law is peculiar. In order to hold a patent, certain portions or all of the patented article must be made in the country within a specified time, and be placed on sale. These conditions, it is claimed, have not been complied with, and the annulment of three Edison, and one Blake—transmitter—patents, is asked by James A. Wright and W. C. Hibbard, of Montreal, who are manufacturers of electrical apparatus. The Minister of Agriculture, before whom the application was brought, voided the Blake patent on the 2d instant. The Edison patents were then taken up. The respondent in the case is the Bell Telephone Company of Canada, whose rights are imperiled. It is claimed that the probable loss to the company, in case of an adverse decision by the Minister of Agriculture—which will be final—will be between three and four million dollars.

The air of Chicago, when seen from approaching suburban trains, shows black and thick with wasted power, floating lazily as well as uselessly over the city. There is sufficient of this lost energy to do many times the labor accomplished by all the steam engines within the corporate limits. Few of us ever stop to contemplate this waste, so constant, so huge. At the convention in Philadelphia, during the discussion on motors, the fact was developed that from the coal pile to the motor about ninety-five one-hundredths of the power was irrevocably lost; and only 5 per cent. utilized! Coming into a large coal-consuming town in the early morning one can see the huge banks of finely comminuted carbon, listlessly hanging over the work shops and other industries, as runaway scholars hang about the outskirts of the school yard, coaxing their more industrious fellows to leave their books and join them in a life of listless vagabondage. We would all have it otherwise, and he who can save another 5 per cent. of that energy which goes under the boiler—see, what he will have done! Doubled the useful energy of every pound of coal consumed.

But, as that cannot be accomplished, the next best thing seems to be to fine those who make this great waste, under a smoke ordinance. An electric light company here was mulcted in $50 the other day for this kind of smoking on the street.

The Western Electric Company are running night and day, striving to catch up. They have recently received orders for a 70 light plant for St. Louis, Mo.; a 60 light plant for Scranton, Pa.; and a fifty for Kankakee, Ill.

Buffalo is to have a multiple switch-board of 4,000 line capacity, with a 1,500 line equipment, complete.

The company are putting in an one hundred number annunciator at the Riverview summer resort hotel, built by the Illinois Central Railroad.

And they have just closed a contract for fitting up the new Marshal Field building with a complete system of thermostats for mercurial fire alarm.

The Minnesota Legislature, after a long, chilly, and uncomfortable season, has finally adjourned. It had one of those fashionable telephone regulation bills, which finally settled down into a law taxing telephone companies 2 per cent. on receipts, after deducting all amounts paid for patent royalties.

The action of the law will not materially change the present amount of telephone taxes, while it cuts off all local tax levies in cities and towns—the 2 per cent. being in lieu of all other taxation.

Dakota is struggling with a rate bill. No legislature is complete or in health which cannot see money in a dive at the telephone pocket.

Prof. J. P. Barrett has been collating a few figures apropos of the comparative expense of gas and electric lights in the Chicago City Hall plant.

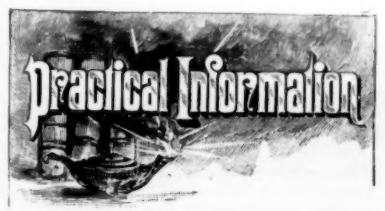
After adding six per cent. on the investment; salaries of four men; the amount paid for coal, oil, waste and renewal of lamps burned out; the expense of changing dynamos, including both the difference between the smaller and larger generators and the labor of placing an excess of 800 more lamps than under the gas regime, and a motor thrown in which runs the machinery in the fire alarm repair shop—after adding all these items together, the year shows an economy of one thousand dollars over the gas bills of former years. Yes, and the electric lamp stove, which comfortably warms the feet of his honor the Mayor, not counted in at that.

Verily the electric light is a good thing in its way.

Mr. W. S. Logue, representing the Edison Phonoplex system, is in Chicago explaining the mystery to railroad people.

CHICAGO, March 7, 1887.

If Washington, D. C., should be selected as the place of holding the next annual meeting, Congress will have the opportunity of seeing what a wide-awake body of men its electrical constituency comprises.



To make lining metal, melt in a crucible 1½ lbs. of copper, and while this is melting get a big ladle and melt 25 lbs. of tin and 3 of antimony; heat it red hot and pour the two together, and stir till thoroughly mixed. This beats babbitt.

To estimate the internal resistance of a Plante or other electrically formed secondary battery may be computed in the following manner; supposing a sulphuric acid solution of 1.25 specific gravity be used, multiply the distance between the plates in centimeters by 6, and divide by the area of the positive or negative plate in square centimeters.

Paraffine has a higher resistance than mica, gutta-percha or shellac. Even when not subjected to mechanical strains, it becomes cracked, though the openings are not visible to the eye. The insulating power becomes lessened, especially if it be in contact with water. Of all the varieties that are sold under the name of paraffine, only that which has the highest boiling point and is clear and hard should be used.

CEMENT FOR FILLING FAULTS IN CASTINGS.—Iron filings, free from rust, 10 parts; sulphur, ½; sal ammoniac, 1 part. These are mixed with water to a thick paste, which is rammed into the "faults." This becomes strong when the iron filings have rusted. The parts which have to be cemented are treated before the operation with liquid ammonia, so as to be perfectly free from grease.

MARINE GLUE.—The true marine glue is a composition of shellac and india-rubber, in proportions which vary according to the purpose for which the cement is to be used. The degree of softness is regulated by the proportion of benzine used for dissolving the india-rubber. When only a small quantity is needed the following recipe may be followed. Dissolve 1 part of india-rubber in 12 parts of benzine, and to the solution add 20 parts of powdered shellac, heating the mixture *cautiously* over a fire. Apply with a brush. Wooden cells for primary or secondary battery are made tight and acid proof by this compound.

Queries and Answers.

To the Editor of Electrical Review:

Why have not constant current machines been built? The method of compound winding suitable for such a purpose is described in Sylvanus P. Thompson's dynamo Electric Machinery. No mechanism would be required to regulate the current.

X. Y.

Ans.—A compound wound dynamo to give constant current, and therefore suitable for arc and multiple series incandescent lighting, is in fact a shunt-wound machine with a few series coils on the field magnets. If the machine develop a high electromotive force, the wire on the shunt must be fine, and therefore costly. This type of machine has been tested, and possibly one or more may be put soon upon the market.

To the Editor of Electrical Review:

What is the resistance of Leclanche and Orne cells? F. A. TRUVER.

Ans—The internal resistance of a Leclanche is about 1 ohm; of an Orne five ohms or more.

FACTS TO BE REMEMBERED.

1. Mercury is made to adhere to any metal by putting a very little sodium with the mercury, the hundredth part by weight is ample. The sodium mercury may be washed off by fresh pure mercury, which continues to adhere.

2. A proof plane may be readily constructed out of a circular disk of gilt paper about two inches in diameter fastened on end of strip of varnished glass.

Telephonic News

*** The Boston Telephone Company has a great deal of new construction under way.

*** The little bill before the Texas Legislature regulating the charge for telephone service was killed in the committee. This is as it should be.

*** Messrs. E. J. Hall, Jr., and W. D. Sargent, of telephone renown, leave on the 17th for Nassau. This trip was planned for last month, but telephone complications compelled delay.

*** The telephone exchange in Newark, N. J., will be improved at once by the new owners, the New York and New Jersey Company. It will, however, still be operated under the former name of the Domestic Company.

*** The general manager of the New England Telephone Company, is said to be kept busy during business hours approving new contracts for telephone sets. The demand for new telephones is very great in Boston and a number of leading New England cities.

*** The telephone rate between Paris and Brussels is fixed at 3f. for five minutes' conversation; and, subject to a deposit of 60f. and to the adaptation of the apparatus at his own expense, any Parisian already having a telephone can communicate direct with Brussels.

*** The Cincinnati Telephone Exchange now occupies a most prominent position in the front rank. The citizens of that town are very proud of their telephone system and the handsome new central office, with its Lincrusta Walton ceiling, electric light, Oriental rugs, silver-plated transmitters, etc., etc.

*** A dispatch from Ottawa, Canada, contains the following important item:—"The Hon. Mr. Carling, Minister of Agriculture, gave judgment to-day in the matter of the application of Messrs. Wright and Hibbard, of Montreal, to have the patent for the Blake transmitter, now held by the Bell Telephone Company, set aside. The Minister decided that the patent is null and void, because the Bell Company have been importing large quantities of complete transmitters from the United States. There is no appeal from the Minister's decision."

*** A dispatch from Washington says: "All the appropriation bills will get through, with the exception of the Deficiency bill, which probably will fail. In it are the items of the expenditure made by the Government in the prosecution of the Bell Telephone Company to set aside its patents. Attorney-General Garland has paid out $25,000 for counsel fees, in violation of the law, and Congress does not intend to appropriate the money to pay these fees. If the Deficiency bill fails there will be no money to continue the suits, and the prosecutions, therefore, will have to be dropped.

*** The result of the conferences between the New York city officers as to electrical subway matters has been the drafting of an act by Corporation Counsel Lacombe, which has been approved by Mayor Hewitt, and will be introduced in the Legislature within a few days. This act provides that the Board of Estimate and Apportionment and the Commissioner of Public Works shall constitute a Board of Subway Construction and Control, with all the powers and duties conferred on the present Subway Commissioners.

The new Board must cause all overground wires and poles to be removed, and have prepared a comprehensive system of underground conduits, as soon as practicable. The conduits, when constructed, are to be and remain the property of the city, and their care is vested in the Department of Public Works. For the payment of the expenses of construction, bonds are to be issued, to bear interest not exceeding 4 per cent., and to be sold at not less than par.

An Electrical Feeder.

Experiments tried with a new electrical device for use in feeding sheets of paper to printing presses prove quite successful. It is automatic, and notice of any trouble is signaled at once by ringing a bell.—*Boston Budget.*

This Could Not Have Been Special Agent F. B. Knight!

A certain Boston gentleman, well known in telephone circles as special agent for the American Bell Telephone Company in the southwest, accompanied by the local manager here, stepped into a barber shop adjoining a "sample room" in this city, for the innocent purpose of washing his hands. In the sample room aforesaid is maintained a dummy telephone arranged on the wall like a bona fide instrument, for "selling" the unsuspicious. The local telephone man he thought himself of the dummy, while the Bostonian was performing the right of ablution, and at the close of the performance called his attention to it as a sample of the devices of infringers. "Why, you never reported any infringers," said the emissary of the great monopoly, eyeing the alien apparatus curiously. "I didn't know there were any in Galveston," then stepping up and looking more closely at the set, he continued, disgustedly, "Now isn't that a fine outfit! Great guns! I should think any sort of opposition would be better than that," saying which he proceeded to try the machine and—the bartender pulled the string! It is useless to attempt to depict the several expressions that chased each other in rapid succession over the elegant gentleman's surprised countenance. To get sold on so simple a thing was too, too much. He seized the suffocating local helloist by the arm and hurried off toward the Morgan dock, where he bought a ticket for Brazos Santiago and sailed on the first ship. Unto this day no man knoweth his abiding place.—*Galveston, Texas, Tribune.*

The Electric Club of New York.

In a recent editorial note that standard publication, *Engineering*, of London, makes mention of the Electric Club of New York, as follows:

"During the last year, a club devoted to the advancement of electrical interests has been formed in New York city. In its membership it comprises the leading electricians in the city, while its non-resident membership includes many electricians in all portions of the United States. The club has rooms in Hotel Dam, and the famed cuisine of this hotel supplies the club. It occupies a field peculiar to itself. While serving as a social center like any club, it forms a rendezvous for those connected with electric interests, either in a scientific or commercial manner, and at the dinners of the club, which are held every month, in place of the conventional post-prandial exercises, a paper is read on some electrical theme, and subjected to a general discussion, which never lags for want of speakers. In this manner this club, by the frequency of its meetings, presents a field for the consideration of side issues in electrical work, which is not afforded by the meetings of technical or scientific societies held at longer intervals, while as a club it affords an opportunity for acquaintance and informal meeting of persons of congenial tastes."

A Strange Meteorological Occurrence in Venezuela—An Official's Account.

The following brief account of a recent strange meteorological occurrence may be of interest to your readers as an addition to the list of electrical eccentricities:

During the night of the 24th of October last, which was rainy and tempestuous, a family of nine persons, sleeping in a hut a few leagues from Maracaibo, were awakened by a loud humming noise and a vivid dazzling light, which brilliantly illuminated the interior of the house.

The occupants, completely terror stricken, and believing, as they relate, that the end of the world had come, threw themselves on their knees and commenced to pray, but their devotions were almost immediately interrupted by violent vomitings, and extensive swellings commenced to appear in the upper part of their bodies, this being particularly noticeable about the face and lips.

It is to be noted that the brilliant light was not accompanied by a sensation of heat, although there was a smoky appearance and a peculiar smell.

The next morning the swellings had subsided, leaving upon the face and body large black blotches. No special pain was felt until the ninth day, when the skin peeled off, and these blotches were transformed into virulent raw sores.

The hair of the head fell off upon the side which happened to be underneath when the phenomenon occurred, the same side of the body being in all nine cases, the more seriously injured.

The remarkable part of the occurrence is that the house was uninjured, all doors and windows being closed at the time.

No trace of lightning could afterwards be observed in any part of the building, and all the sufferers unite in saying that there was no detonation, but only the loud humming already mentioned.

Another curious attendant circumstance is that the trees around the house showed no signs of injury until the ninth day, when they suddenly withered, almost simultaneously with the development of the sores upon the bodies of the occupants of the house.

This is perhaps a mere coincidence, but it is remarkable that the same susceptibility to electrical effects, with the same lapse of time, should be observed in both animal and vegetable organisms.

I have visited the sufferers, who are now in one of the hospitals of this city, and although their appearance is truly horrible, yet it is hoped that in no case will the injuries prove fatal. WARNER COWGILL.

U. S. Consulate, Maracaibo, Venezuela.—*Scientific American.*

The Two Subway Bills for New York.

An interview with Mr. Daniel L. Gibbens in relation to the two subway bills now before the Legislature, to which Mr. Gibbens has given considerable attention, is published below:

"The proposed legislation for the burial of the wires in New York City consists of two bills, one of which provides for the carrying out of the work by the present Board of Commissioners, and the other, which emanates from the office of the Mayor, looking to the assumption of the work by the city directly, and the payment of the necessary expenditures out of the city treasury.

"The passage of the first of these bills means the prompt placing underground of the electrical conductors, and the control and management of the subways by public officials, without the expenditure of a dollar of public money, and without a chance of liability or loss to the city. It would result in the saving to the taxpayers of the $40,000 per annum now expended for department wires, and a fair share of the revenue accruing from the subways, in the event of the franchise proving of value.

"The enactment of the Mayor's bill means the interruption of the work until grave legal complications have been adjusted; the entering of the city into a novel and dangerous speculative enterprise; the certain expenditure of many millions of the public money; the liability to the loss of much more; the possible failure to accomplish the work, and the danger of extravagance and corruption which always attends the undertaking of new and extensive jobs by the public.

"It seems to me to be a serious departure from the well-settled principles which have so long governed us, for the city to attempt to do that which can be as well and safely done by private capital. If it is proper for the city to construct electrical subways, it is equally proper that it should build poles for the wires, construct and own railroads and ferries, lay steam-pipes and gas-pipes, build houses for rent on the public land, and do all the other many things which are so far public in their nature as to require public supervision, but which have heretofore been done under public supervision at private risk.

"It seems a matter greatly to be regretted that the introduction into this affair of a new and dubious doctrine in municipal government should be allowed to endanger and delay a work in which the public interest of citizens is so centered."

The Brooklyn Subway.

ROSSITER W. RAYMOND EXPLAINS SOME POINTS OF DOUBTFUL UTILITY.

"The manner in which the subways are constructed in Brooklyn," Mr. Raymond says, "is entirely different from the plan used in New York. They have completed up to date 65,000 feet of underground conduit, and the actual capacity of the conduit is 7,400 miles of wire. In this subway 13.69 miles of cable have been drawn, and these cables contain 1,232 miles of single wire. The ducts in this conduit which are to be used by the telephone company are not all filled, space having been left for the wires which will be necessary as business increases. Two ducts are reserved for the city, but used only to a very small degree, as the city authorities have not made much use of their privileges thus far.

"Out of the 1,232 miles of wire which have been laid in the conduit, 893 wires having a total length of 500 miles, are being used by the companies owning them. The wires that are not in use could be put in operation at once, and many more miles of cable would have been drawn into the subway but for the action of the Aldermen of Brooklyn. The Board of Aldermen in December last stopped the whole business of putting wires underground by ordering the Department of Public Works not to grant permits to any one to open streets for the purpose of laying cables, so the companies which have their cables already laid in the subways are unable to make the necessary connections with their terminal lines, and thus do away with a large number of overhead wires. If the companies were to be allowed to make these connections asked for, a large number of the overhead wires in some of the principal Brooklyn streets would be taken down immediately. For some unknown reason the Aldermen have done this thing, and the work is actually paralyzed. The Commissioners hope to get relief before long, and the work will then proceed.

"The conduit is built in the form of a box. One and one-half-inch lumber is used in its construction. This lumber is all creosoted to resist decay. This box is divided into different compartments or ducts, each two inches by three inches in the clear. One-inch creosoted lumber is used in making these partitions. The number of ducts in each conduit varies from four to ten, the average being between six and seven. Manholes are placed along the line at distances varying from 200 to 1,000 feet. These manholes are rectangular, measuring 30x52 inches. They are five feet deep, and lined with brick, laid in cement. The covers are of iron, and are the full size of the manhole, it being considered better to have the whole manhole exposed when the cover is taken off. The cover is packed with rubber."

He makes also the following statement:

"No attempt has been made to make the conduit either gas or water-tight. On the contrary, it is ventilated at intervals, in order to allow the gas which may accumulate to escape. At the joints the boards are overlaid with felt, which is nailed down and pitched, as are also the cracks between the planks forming the conduit, the object of this being to keep out silt and mud, which would clog up the conduit and interfere with the drawing-in of the cables. The result of this has been somewhat unexpected. No attempt was made to have the conduit gas or water-tight; but the result has been that the

whole conduit has been completely dry. There has been no moisture in either conduit or manholes, even after heavy and continued storms. We have found the conduit satisfactory in every respect. There is no doubt but that properly creosoted timber will last for years in this climate, fifty years, at the very lowest, being its estimated life.

"Creosoted timber has been used for years for the purpose of burying telegraph wires, Mr. Plympton, of our Board, while recently in England, collected information in regard to its use. Mr. Preece, the electrician of the British Postal Telegraph service, said that they had long discarded the use of creosoted timber and were using iron pipes. The reason of this was that he considered that the wood had afforded insufficient protection. Investigation showed that the wood which had been used was very thin and the conduit had no top. The strength or weakness of the English conduit had no relation to the Brooklyn plan, as we were using one and one-half inch timber, which was braced by cross sections, making a totally different condition of things. The durability of the creosoted wood was certainly proved by the English experiments. A piece of wood which had been buried for thirty years was dug up while Prof. Plympton was in London, and was found to be as sound as on the day it was buried.

"The subways are constructed and owned by the Western Union, and Gold and Stock Telegraph Companies, and the New York and New Jersey Telephone Company. As over four-fifths of the wires in Brooklyn are owned by the telephone company, you can see that these three companies have almost all the telegraph and telephone wires in the city, and if they are once put underground there will be very few left above ground. The question of a subway for the arc light wires is something yet to be decided, and we hope to reach some decision in regard to that point in a short time.

"As soon as the obstructions in our way are removed we shall get to work again finishing the subway. Plans are in preparation for the work to be done up to November 1 next, and by that time, if everything goes smoothly, about one-half of the total telephone and telegraph wires in Brooklyn will be provided for. The other half consists of scattered wires in outlying parts of the city. The business part of the city could be comparatively free from wires within a year.

"The obstructions to which I refer are the interference of the Aldermen and legal complications which may result. A great difficulty which has existed hitherto has, I hope, been removed, namely, the entire absence of means at the disposal of the Board. For a good deal more than a year, the Board not only worked without salary, but paid all its expenses; and consequently was much crippled in its work. As to the city fire and telegraph wires, one plan is that they shall be experimentally laid in the existing subway, and that the establishment of a complete underground system for them shall be gradual. To put the wires of the Fire Department, for instance, underground at once and independently, would cost the city over $300,000. This matter is, however, beyond the jurisdiction of our Board.

An English Expert's Scheme to use Electricity in Warfare.

Sir Andrew Clarke, of England, a high authority on coast defenses, and formerly Inspector-General of Fortifications is reported as follows in a recent interview:

"My plan does away with all fortifications. Instead of alleged invulnerability, my principle is invisibility of defenses. When you erect enormous fortifications you offer a target for the enemy's shot. Let your turrets and cupolas be never so thick, heavy shot is likely to play the mischief with their mechanism. With Lieut. Maxim, I have worked out what I call a 'disappearing gun system' which can be applied to the heaviest guns made. This renders fortifications unnecessary. The gun occupies a hole in the ground. When in action it is raised by a sort of hydraulic elevator, and after firing sinks into the pit again to be reloaded. Thus it is exposed for only a few seconds. When in the pit it can only be hit by a vertical or plunging fire, and the likelihood of such shots striking their mark is infinitely small. Covered ways shelter the men who load the gun, so that the enemy has practically nothing to aim at. A gun operated in this fashion commands a much wider area than when mounted in the fort. By means of electricity the gun can be raised, lowered, trained and discharged by one man in a position of safety a hundred yards or even a mile away. This has been actually accomplished. We are at work on a plan whereby machinery for loading the gun can also be operated by electricity. If this is successful the gun can be wholly worked from a safe distance.

"When you can dispense with fortifications you have more money for heavy guns, submarine mines and torpedoes. Heretofore I have vehemently urged the colony of Victoria, Australia, to build no more forts. I believe such costly defenses will soon be regarded as obsolete in defensive warfare. The United States derives great advantages from her distance from Europe, because the difficulty of using first-class iron clads so far from their bases is very great."

Boulanger Discovered by an Eminent Electrical Worker, at the United States Legation.

(From London *Truth*).

Since Prince Bismarck can do nothing to shake General Boulanger by direct attacks, why not attack him through the man who bore him on his back into power? Clemenceau? No. You have read, perhaps, in the second of the series of articles on foreign politics in the *Fortnightly*, of a Dr. Cornelius Herz, Grand Officer of the Legion of Honor, in connection with General Boulanger, M. de Freycinet and General de Menebrea. But, for the enlightenment of those who do not know the ins and outs of French politics, I had better explain who Dr. Cornelius Herz is. This personage, you will observe, has a name that would do for a novel of Jules Verne. If ever that exciting writer takes for his subject the theory of mental suggestion and transfer of volition I should say to him: Study this doctor, and make him the central figure of your book, and I promise you that it will be the most telling of any that you have ever written. The theory I have just mentioned is the scientific explanation of much of the demonology of earlier ages. I saw it tested and proved by the famous Professor Charcot, who holds that persons with brains of a perfect balance, rich in vitality, can, without speaking, and even at a considerable distance, suggest ideas to persons of ill balanced and weaker brains and make them act as they desire. In short, they can put into their heads, without the aid of speech or pantomime, what they wish them to think and do, and the poor limp creatures reflect the thoughts of the stronger minds and obey their orders.

Herz unquestionably has exercised the most extraordinary will power in getting the Rothschilds to embark in a concern out of which they wanted to keep, and in making them sink such a heap of money in it that they must go on to the glorious or the bitter end. His most extraordinary feat has been the creation of General Boulanger, whom he met by accident when he was only a colonel, at Mr. Levi Morton's. Herz took to the young officer because he thought he had "go" in him, and had a strong dash of British blood, which it was a comfort to meet with after the old routine bound military men whom he had been in the habit of seeing. Dr Cornelius is an American citizen and was reared in California, where he learned to speak English with a slightly Irish accent. He said to Boulanger: "I feel like serving you and giving you notions." Boulanger at once took to him, and his new mentor said, "My first notion is that you should open up your mind by going to the United States. As you are young and handsome, and know English, you're the right man to represent the French army at the coming Yorktown celebration." "But," replied the officer, "I've no one to back me at the War Office or anywhere else." "Never mind," said the magnetic man, whose little gleaming eyes had looked through and through Boulanger and taken note of all the "stock" that was in him. In a short time the handsome officer, who had been raised a peg, was sent on a showy mission to Yorktown and saw what a real republic might accomplish. He came back and his patron willed he should go to Tunis, wither he went with a higher grade. When he was there the friend willed that he was to be named Minister of War on the occasion of the next Cabinet crisis, and as he desired, so M. de Freycinet did.

All the madmen, the feeble-minded, and most of the women, are agog for Boulanger, who has the sensible people on his side, because he is such a good administrator. I never saw any one better illustrate the policy in great affairs of the go-ahead principle than the half-British war minister of the French Republic. Clémenceau is the fast friend of Boulanger, and they both have stood shoulder to shoulder ever since the last Ferry cabinet broke down. But he was far from being his creator, and, indeed, would have preferred a general who was a *persona grata* to the Gambettists, though not for that reason. The action Boulanger took in dealing with the princes made their friendship very close.

OUR ROCHESTER LETTER.

A sad accident occurred here Friday night during a heavy wind storm. The Western Union Telegraph Company had set poles on the Court street bridge, placing them between the bows of the bridge, an old fashioned bow-strung bridge. The poles were blown down and carried with them the bows of the bridge. Unfortunately a young woman was crossing at the time and lost her life in the raging waters of the Genesee. She is supposed to have gone over the falls.

The result of this mishap was to awaken renewed interest in the underground question. Many prominent citizens, who know as little of the obstacles in the way of such an accomplishment, as did Mrs. O'Leary's cow of the results she might expect from kicking over a lighted lamp, when she started the Chicago fire, pronounce the feat practicable, of course. It is being done in other cities, why not in Rochester?

I hear nothing of the writing telegraph. My last letter should have located the Sawyer-Man installation for the Gould's Manufacturing Company at Seneca Falls.

Messrs. Schmidt-Kaelber & Co., the electrical men, report business very good indeed, an improvement over last year. They have just finished the guest call system bell work, etc., for the new Richmond hotel, Buffalo.

ROCHESTER, N. Y., Feb. 28, 1887. H.

* * The Pacific Coast Electrical Company has sued Nathaniel S. Keith, at San Francisco, to obtain an accounting and an injunction restraining defendant from collecting any debts at present outstanding. The defendant was employed by plaintiff as an electrician at a salary of $5,000 a year. Under the agreement between the parties plaintiff was licensed and empowered to exclusively manufacture certain electrical apparatus. The defendant is charged with receiving money for such apparatus sold by him, for which he refuses to account to plaintiff.

A Chicago builder has taken time by the forelock, and made arrangements for the future in the matter of telegraph, telephone and other wires. The Brother Jonathan Building, facing the Board of Trade, on Sherman avenue, so far has had no cutting done by the wire butchers. Holes through walls and partitions, mouldings beneath or upon which to attach wires or insulators—these were all provided for and completed before the wire men got in their work.

TELEGRAPHIC

.... Two large copper wires have been strung between Buffalo and Cleveland, and will be used exclusively for operating the quadruplex.

.... Detroit is considering the practicability of establishing a city electrical department, to be controlled by a city electrician, somewhat similar to Chicago, where Prof. John Barrett so acceptably presides.

..... The *Tribune* says that the Southern Telegraph Company, which was sold under foreclosure proceedings at Richmond, Va., was bought in the interest of the Western Union Telegraph Company, which has owned a majority of the bonds for nearly a year.

.... D. N. Webb, a New Jersey telegraph operator, was in his office when the station was struck by lightning and was seriously injured, his shoes being torn off and one side of his body being paralyzed. He is now at Newark. Beyond the burning of the wires, no injury was done the office.

.... The Adirondack, Lake George and Saratoga Telegraph Company has filed a certificate of incorporation. It has a capital of $100,000 in 2,000 shares. The route will include North Creek, Warren county; Lake Placid, Essex county; and Paul Smiths, Franklin county. The incorporators and shareholders are J. J. Barry and Herbert Smith, of New York, and Uriah M. Osborn, of Rahway, N. J. Headquarters will be at Saratoga, N. Y.

.... The bill for the taxation of telegraph companies has passed the House in the Dakota Legislature. This bill provides for the taxation of this property as property of individuals, and that the tax shall be sixty cents per mile for the first wire, thirty cents per mile for the second, and twenty cents per mile for each additional wire. It provides in addition that telegraph companies must take out license, and a failure to pay the tax abrogates the license.

.... The Atlantic Telegraph Company has been leased by the Baltimore and Ohio, and a cut of rates between Portland, New York, Baltimore and other points has already been announced. The Baltimore and Ohio will also, in the early spring, extend the Atlantic lines through to Bangor, with offices at Auburn, Lewiston, Augusta and other important Canadian cities. The Atlantic lines will also be extended to Manchester, Concord, Nashua and Keene, N. H.

.... I presume, says a correspondent, there is more appreciable difference in telegraph operators than in any other class of workers in the world. The old timers delight in talking of receiving fifty words a minute, and sigh wearily as they refer to auld lang syne and the decadence of speed in the present generation. This is all very well, but thirty-five words per minute is considered far above the average, and when an operator is receiving even that number he is pushed, and frequently resorts to abbreviation. Lady operators as a rule are accurate, but are physically incapable of the heavy work entailed by press reports for city papers. Put a lady operator at the instrument in a small city where pony reports are received and she will take twenty words a minute and do it well. But when it comes to using the stylus on manifold, where a large number of copies is to be taken, a lady does not possess the requisite physical strength to accomplish the task. Operators are eccentric, and their style of work differs greatly. Once they become set in a certain channel they never change, and while experience gives them better control of their work, there is no perceptible improvement in penmanship. Telegraph operators who can carry on a conversation and receive at the same time are very scarce.

ELECTRIC CLUB MEETING.

(*Continued from page* 3.)

These also contained 60 pounds of No. 7 *B* and *S* gauge, double insulated wire ; but instead of surrounding the legs of the electro-magnets, they surrounded the armature longitudinally magnetizing it directly, while the electro-magnets acted like the shell in Fig. 20, viz., as conductors of the magnetic current from side to side of the armature, furnishing a double circuit for the magnetic current.

The machine was now tested again and the results proved that the machine had been greatly improved.

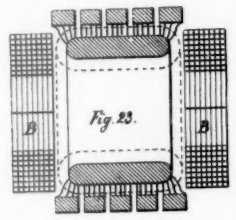


Fig. 23.

Very little magnetism could be detected on the outside, although but a small part of the exciting helices was enclosed in the outer bars.

The magnetic conditions in the two forms seemed to be about as shown in Figs. 23 and 24, in which the magnetic circuit of both machines is shown in horizontal cross-section.

The magnetic current in the one case, when four coils magnetized the five bars on each side as in the common method, made very strong poles of the bars opposite the armature, which would attract any bar of iron with considerable force.

But in order to find external magnetism when the new coils were used it was necessary to use a compass needle.

The electro-magnets would not hold a ten-penny nail. Yet when $\frac{7}{16}$ of the longitudinal helix was used the electromotive force of the machine was equal to that when the four common coils were used.

Careful measurements showed that the machine was at least 30 per cent. better with the new coils than with the old, and a continuous use of some months to feed a number of 50 volt incandescent lights has demonstrated the fact that it is as reliable as any machine of its size using common electro-magnets.

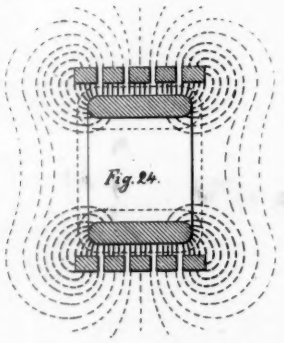


Fig. 24.

Many other experiments, not described in this paper, were made to verify the conclusions reached by the writer, and in all cases the results were the same.

As in the unipolar and bipolar machines so in multipolar machines the value of the wire in the exciting helix was nearly doubled when used to magnetize the armature directly instead of by induction by means of electro magnets as heretofore employed, and it would seem as if this construction furnished the greatest electric effect with a given quantity of exciting wire, and the smallest loss of current.

The conclusions reached may be stated as follows :

The ideal dynamo machine should have an armature core of a length about equal to its diameter, so that the armature coils would enclose the greatest quantity of magnetic metal, with the least length of wire.

The exciting helices should surround the armature longitudinally and armature and exciting helix should be surrounded by a magnetic shell laminated probably like the armature core and of a cross-section equal to the longitudinal cross-section of the armature core.

This construction would furnish a magnetic circuit so short that it could not be cut a second time, and the resistance in the magnetic circuit itself would be so small that no part of the magnetic current would complete its circuit in spaces.

DISCUSSION.

DR. MOSES: There is scarcely any one who has constructed any part of a circuit who has not had some communication with a dynamo machine; scarcely any one who has had anything to do with the electric light, but has been led back to the dynamo machine. The advantages of such a piece of apparatus must assert themselves. Will the inventor of this particular machine be so kind as to tell us wherein are the great advantages that arise from those two forms of machine that now exist? I would like him to commence, perhaps, with the field pieces themselves, and explain to us wherein is the advantage of doubling the outer magnetic circuit. I simply ask these questions as opportunities for him to explain the advantages of that machine. Will he be so kind as to show us where the advantage is in bringing the outer lines of force as close as possible to the inner ones; that is to say bringing the lines almost into a closed circuit and yet having the inside coils within it? Faraday, in some of his experiments, has called attention—and by the by in a form of iron very similar to this—to the very remarkable fact that where you have your lines of force going through an iron atmosphere that the interior seems to be entirely devoid of any electrical action. Sir William Thompson has made use of that in the protection of his compasses; and I can readily see if you can preserve the lines, there would be some advantage in preventing that waste that occurs in the interior of the magnetic shell. Now if Mr. Eickemeyer would tell us what is the course of the current as emanating in Fig. 20 from the coil *B*, I think he would make our questions clearer. In coil *B*, in Fig. 20, what is the course of the current around the armature? That shell is like the magnetic shell that I spoke of that Faraday experimented with, which is simply an outer shell magnetized, whether interiorly or exteriorly matters little, of course.

MR. EICKEMEYER : The dotted lines which run through the center of the central core and again through the center of the outer shell are supposed to indicate the direction of the magnetic current.

DR. MOSES : That is about the action, then, of the long pole magnets that are used in telegraphy. In England, I think, particularly, they make use of these long pole magnets.

MR. EICKEMEYER : The illustration I used here is simply the well-known cup magnet where one of the poles is on the circumference and the other pole is in the center. I simply used it as an illustration to show that where the two poles are brought together, lines of force will radiate from the outer pole to the center pole. The magnetic circuit passes through the center, through the outer shell, and radially through the center again.

DR. MOSES : That action of the magnetizing current in the helix is simply to make the right hand extremity of that core A, say of plus polarity, and the left hand one of negative polarity, and the object of the iron shell is to conduct those lines around to as close proximity as possible.

MR. EICKEMEYER : To as close proximity as possible.

DR. MOSES : Now what great advantage do you find in having those lines of force so closely coupled ?

MR. EICKEMEYER : The result was as I stated. If we used the internal core only and rotated the armature precisely at the same speed, magnetize the core with the same current, and the relative current value between the two devices, without the shell and with the shell, was as one to two.

DR. MOSES : Is Mr. Eickemeyer aware of the experiments of Deprez ?

MR. EICKEMEYER : Oh, yes ; I am aware of them.

DR. MOSES : He does not find such great advantages as some of us imagine from bringing the poles so close together.

MR. EICKEMEYER : I have found that the closer the circuit the less will a machine be affected by the ampere turns. I am not so used to your electrical phrases. But if you build a machine with an open circuit, that is, a machine that has facility to pass its magnetic current into space, it will answer to an increase of the exciting current pretty much indefinitely. While in the other case, when you enclose it in a shell, making a closed circuit of it, you reach its maximum much earlier, but you reach that maximum at a cost much lower than you reach it when you have the open circuit machine, if I may use that expression. It has its advantages and its disadvantages.

DR. MOSES : Do you find by increasing, as you suggested, the size of your field pieces indefinitely that you increase the facility with which your magnetic currents can circulate through it ? Can you increase it indefinitely ?

MR. EICKEMEYER : In reference to that statement which I made, I would say that throughout the whole paper I tried to rely upon one fact. I retained the same armature, and I approached gradually to the cross-section of the armature, and as long as I kept increasing the cross-section and did not reach the cross-section of the armature, why the quantity of iron seemed to be a representative of the relative value of the machine, irrespective of the number of windings.

DR. MOSES : My reason for asking that is perhaps to inquire, as well as to suggest, whether it would not be advisable to determine whether an indefinite expansion of the iron might be no serious cause of fault in the current ? Would not the current perhaps distribute itself along the interior shell entirely independent of the exterior mass of iron? Since the lines of force tend to come towards the inner portion of this hollow pile, might it not be possible that the indefinite expansion of the iron would be no detriment whatever ?

MR. EICKEMEYER : In the experiments illustrated in Figs 15 and 16, where, as I said, there were two bars of iron fastened against that little dynamo machine Fig. 9, and then there were bars provided to increase the size of the cross-section, when the cross-section of these bars was greater than the bars *K* and *I*, it was of no consequence, you could pile on any quantity. But as soon as the cross-section was below the cross-section of *K* and *L*, then of course the current was reduced. The large quantity certainly did no harm ; it was simply useless.

DR. MOSES : Could you give your views as to what you consider the reason that large magnetic masses of metal in very large types - say for instance the Edison type of machine—would be useless ?

MR. EICKEMEYER : The reason why I should consider them—not useless, exactly, but rather detrimental, if wound in the ordinary ways, is that there is so much surface which is actually exposed to the air, where the magnetic current can pass out into space. If the magnetic action was concentrated upon the inside, why this mass of iron outside could be no detriment, but where you have the enormous amount of face—the enormous amount of exterior, there is no doubt in my mind that the scattering of the magnetic forces is greatly increased.

DR. MOSES: That scarcely holds with any other atmosphere for the propagation of motion. The condensation of an atmosphere does not, for instance, seem to prevent the rapid propulsion of sound waves, if we can make an analogy between electrical and sound waves. The denser the medium, the greater the facility with which they are communicated—the greater the speed. Now, may it not be that the greater the mass of iron that is there, the greater the facility for the conduction of electricity, aside from its magnetic form? Are there not, perhaps, in these electric currents that are circulating, Foucault currents that will form in field magnets, and that produce this consequent plus? Is there not, perhaps, electricity in some other form circulating through the mass of metal and facilitating its magnetic capacity?

Do I make myself clear?

MR. EICKEMEYER: I cannot exactly say that I undestand the question fully.

DR. MOSES: In this way—in a large mass of metal that seems to do nothing but to act as a magnetic medium, why should there be any advantage in increasing the mass of metal, unless it were that you diminish something that was an impediment to this magnetic action? That is to say, if electricity will be converted into a magnetic form, may there not be in iron some intermediate form between magnetism and ordinary current electricity?

MR. EICKEMEYER: Well, I have no opinion. I have simply experimented with electric currents to see what they did on cores of iron. I never tried to penetrate into the nature of the action that takes place.

DR. MOSES: My reason for asking that is that in closed magnetic circuits where you have no magnetic action, you may still have these magnetic effects produced. Therefore, there is a surmise that there is an intermediate form between current electricity and magnetic electricity.

MR. EICKEMEYER: In my experiments, as I carried them on, I finally reached the conclusion that what is generally termed a pole in a dynamo machine of any form is really a fault. That if we could construct a machine that had no poles, that that would be the most effective machine. If you take the same quantity of iron and wind it in ring shape, and make an induction coil of it with a closed circuit, then cut that up and straighten it out, the closed circuit is a much better induction coil than the open circuit.

DR. MOSES: That is what I wanted to call your attention to—that perhaps the best dynamo machine would have no poles at all

MR. EICKEMEYER: It should not have any.

DR. MOSES: In your experiments with the Faraday disk you found that by the inserting of an iron disk you got corresponding centers of the lines of force, due, of course, to the magnetic medium of the disk itself. Faraday appears to have made similar observations and they are very interesting. Have you in connection with that some experiments in respect to the cutting of those lines of force in the ring?

MR. EICKEMEYER: I stated that in the first place when the ring was cut once it produced a deflection in the galvanometer of 19 degrees when I used a copper disk, and it increased to 33 when I used iron.

DR. MOSES: That scarcely accords with Faraday's experiments, who found rather a diminution in the use of iron.

MR. EICKEMEYER : That is what I found, and I experimented pretty conscientiously. I have here a photograph of the identical machine that was used. That will show you how the experiments were made.

MR. GARRATT: Mr. President, in listening to this very interesting discussion, there are three questions which suggest themselves, which I know it would be very interesting to us if they could be answered, and the first is this:

Mr. Eickemeyer has stated that the efficiency of the machine, working on what is termed an open or closed circuit, was as one is to two. Can he tell us if he has found a mathematical expression which will exactly cover that? Is it exactly as one is to two, or is it as 1 to 1.9 ; or has he been able to figure that accurately ?

In the second place, where air space has been substituted by a mass of iron for the conduction of lines of magnetic force, has any mathematical expression been found to govern that conductivity, the same as we know the conductivity of electricity in a conductor which is inversely as the square of the cross-section ?

The third question is this : In proportion to the increase of the efficiency of this machine was the element of force used in rotating

that armature at a given speed? It was stated that the armature was rotated at the same speed in all these tests. Was it found that the armature absorbed the same amount of horse power to keep it at a given speed, and was that taken into consideration where the efficiency was as one to two, as stated?

The three questions are again:

Was the gain exactly as one to two, or is there a mathematical expression for it?

Is there a mathematical expression for the conduction of lines of magnetic force through a mass of iron in contradistinction to their conduction through air?

In the efficiency stated as being approximately as one to two, was the amount of horse power absorbed by the armature taken into consideration in the calculation, or was it supposed that the same amount of energy was absorbed in both cases?

MR. EICKEMEYER: I will try to answer your questions, but in the reverse order. I never imagined that the machine furnished a greater quantity of current with the same amount of force in the one case than it did in the other. I supposed that the value of force or the value of power to convert it into electricity was equal in both cases, that is, for equal quantities.

MR. GARRATT: That is, you absorb twice the horse power?

MR EICKEMEYER: I should suppose so. I have made no measurements in that direction.

MR. GARRATT: Then there is no gain on the amount of horse power.

MR. EICKEMEYER: I do not pretend that there is any gain on the amount of horse power. The value of the current was about as one to two.

MR. GARRATT: You expressed the value of the current in watts?

MR. EICKEMEYER: I am an amateur, and am not so very familiar with the technical phraseology of electricians. As I said in the paper, I ran my machine at the same speed, as nearly as I could. I used the same exciting current, as near as I could get it, measured it as well as I could, and I found that in the one case, running at the same speed, using the one device, it deflected the galvanometer to a certain point, and in the next device it deflected it to the next point; so I reached the conclusion that the machine had been improved. Now as to mathematical formulæ, I must confess that I often wished there was such a rule, so that I, or any other layman, could figure the size of the magnetic field he wanted. But so far I must say that I have not succeeded in establishing the relative mathematical value of the two things, although I have tried dozens of times to devise some means by which I could find the real value. If I live long enough I am in hopes that I will do it yet. (Applause.)

On motion of Mr. Dutton a vote of thanks was given to Mr. Eickemeyer for his able and interesting paper.

A small electric motor of Mr. Eickemeyer's was exhibited, the power being furnished from a Volta-Pavia battery, which was kindly loaned the Club by Mr. A. V. Garratt.

The Club then adjourned to meet March 21, to nominate officers for the ensuing year.

Mining by Electric Light.

In conversation with a practical placer miner recently, says the Humboldt *Standard*, the subject of working hydraulic mines by electric light was discussed. He is of the opinion that it is one of the most valuable improvements which could be introduced in connection with that system of mining, and particularly in districts where only a short season of water is afforded. Ordinarily, where large reservoirs are used and only day work is done, one-half as much water goes to waste during the night as is used during the working hours. With the aid of the electric light this waste water could be utilized and made to yield the same profit as that used in the daytime. The electric light is largely used in France in connection with farming operations, and with great benefit, for the reason that men can do more work during the night hours, because the air is cooler. It is told that one agriculturist works a seventy-five mile circuit of wire no larger than a thread with a fourteen horse power engine. The suggestion of electric light for mining purposes originated with Mr. Allen, who has a rich claim two and a half miles from Orleans bar. No doubt Mr. Hamilton, who is handling the English company's mines there, will warmly second Mr. Allen's proposition. We believe that an electric plant capable of performing the service required could be laid down at Orleans bar for $1000—at most $1200. With the cheap water power which would be afforded, the enterprise would prove to be a lucrative one.

New Electric Motor.

A number of the stockholders of the Silvey Electric Light and Motor Company met at the factory a Lane & Bodley's yesterday afternoon, to witness the trial of a new electric motor manufactured by the Silvey Company. The following directors were present: Col. P. P. Lane, James E. Mooney, John E. Bell, George B. Kerper, S. M. Lemont and George M. Roe. The trial was made under the direction of Mr. A. R. Foote, business manager, and Mr. Silvey, the inventor. The current was supplied from a twenty-five light incandescent dynamo, located in the factory. The motor is less than fourteen inches square, and a test made indicated that the power developed was between three and four horse-power. It would lift a loaded elevator with apparent ease. The motor was reversed instantly while running twenty-five hundred revolutions a minute, and was stopped and started as readily. The test was satisfactory in every way, and Mr. Kerper said that experiments would now be made with electricity on his cable road extension. He was quite enthusiastic over the performance of the little machine. The Silvey Company has large capital behind it, and will now add the motor industry to that of electric lighting.—*Cincinnati Commercial Gazette.*

That Edison Decision in England.

(From the *Pall Mall Gazette.*)

In the electric lamp patent case the utmost that Mr. Edison's experts had claimed for him—the utmost that even the Attorney-General could plead on his behalf—was that he had invented electric lamps having in them as their incandescent part something which was to be made of a filament of vegetable fiber or something else which was afterward to be carbonized. But the united acumen of Lord Justice Fry and Lord Justice Bowen "interprets" the claim so as to give more to the inventor than even his own experts and counsel claimed for him. They award to him the right to any carbon filament, however made, irrespective of the rights of the public or of other inventors.

Lord Justice Cotton differed from his brethren on the bench. In this state the case will naturally go forward to the House of Lords, who will have to decide whether the patent shall be confined to what the patentee claimed or whether the British nation will give him more than he invented.

Our appreciative and esteemed contemporary, the Boston *Commercial Advertiser*, says:

"One of the handsomest publications that come to our table is the ELECTRICAL REVIEW, published in New York. It is not only a credit to the publishers, but to every editor and artist connected with it. Its typographical appearance too is excellent. Mr George Worthington is the editor. Mr. Loren N. Downs, president, and Mr. Andrew J. Dam, vice-president and treasurer of the publishing company."

—— Several months ago a number of enterprising Milford men subscribed $1,000 each, as an experiment, to put in electric lights. They purchased the boot shop formerly occupied by the firm of A. C. Mahew & Co, which they fitted up in a suitable manner, putting in a better engine and electric dynamo, and put up a line of wire with several arc lights on the street and in several stores. These were run several months free of expense, giving so good satisfaction that the town voted to adopt the light and put in several new ones, which will be increased at the next March meeting. The company soon put in the incandescent light, and the business has grown so that they have increased their capital to $60,000, and have two eighty horse power boilers, three engines, two of them sixty horse power, and one twenty-five horse power and a new dynamo. They have over fourteen tons of wire in use, with forty five arc and 600 incandescent lights, lighting twenty five stores, printing offices, barber shops, hotels, engine houses, etc. Several private residences also use them. All the electric lighting apparatus was furnished by the Brush-Swan Company of New England.

—— A company is being formed to put in electric lights at Knoxville, Iowa. Mr. J. D. Reeder is at the head of the movement.

J. A. Berley's "Universal Electrical Directory" for 1887, has just been issued, and is again to be commended as a very complete and interesting work, of value to the entire electrical fraternity, and thoroughly covers the foreign field. The Directory is published by Wm. Dawson & Sons, 149 Upper Thames street, London, E. C., whose experience in this line has never appeared to so excellent an advantage as in the present volume.

—— Through Mr. D. J. McCanne, superintendent of the Gunnison Gas and Water Company, of Gunnison, Colo, we learn that his company has secured an amendment to its charter, authorizing it to use electric light in conjunction with gas light. The company does not purpose putting in the electric plant until toward the end of the present year, but wishes, in the meantime, to carefully canvass the merits of the various systems, with the view of securing a plant which shall represent all the latest improvements. Manufacturers of electrical machinery will do well to make a note of this.

—— Last week contracts were closed by the Tacoma (Washington Ty.) Gas Light Company with the American Company for a plant to run in connection with their gas plant. The Seattle (Washington Ty.) Gas Company also contracted for a plant with the American Company. The Glens Falls Gas Light Company, Glens Falls, N. Y., also contracted with the American Company for a plant. The plant being built by the American Company for the Orange, N. J., Gas Company is about completed and will start up this week. The Montreal Gas Company, Montreal, Canada, are negotiating with the American Company for a plant, they having decided to enter the electric light field in opposition to the Thomson-Houston Company now being operated in Montreal.

—— A meeting of the stockholders of the Lane Spring Hinge Mfg. Co. was held recently for the purpose of reorganization. The company will hereafter be known as the Asbury Park Electric Light and Power Co. The manufacturing department will be disposed of, and they will hereafter give their entire attention to electric lighting and the furnishing of power by electric or steam motors. One of the objects of the reorganization is to reduce the capital stock to a cash basis. The capital stock is now $50,000 with $27,000 issued, and the balance of $23,000 will be sold as needed for the purpose of increasing the business. The company now have in contemplation the addition or 50 arc and 500 incandescent lights. A statement was made of the past year's business, which showed net earnings of about ten per cent. upon the capital invested.

—— On February 10th the managers of the various Edison illuminating companies of the United States met in convention in Rochester, N. Y. There was a large attendance, the object of the meeting being discussion and comparison of notes in reference to the progress of incandescent lighting in the different cities in the country. In addition to its franchises in reference to illumination the Edison Company has the right to use the system for the distribution of current for motive power. This branch has been developed in some of the oldest cities with most gratifying success for such purposes as the running of printing presses, ventilating fans, ice cream freezers, circular saws and similar uses, but it was reserved for the Boston station, started in February of last year, to exemplify the possibilities which are before the lighting companies in the sale of current during the mid-day hours of smallest output in illuminating energy. Under the energetic management of the New England superintendency of the Sprague Electric Railway and Motor Company, who adopted in Boston the policy of selling motors outright to the public, about fifty motors have within six months past been connected with the Edison Company's wires, for services before enumerated, and especially for elevators requiring from ten to twenty horse power in motor capacity.

ELECTRIC LIGHT NEWS

—— The Newark Electric Light Company have just installed 41 Waterhouse arc lights which are giving very good satisfaction.

—— The Standard Electric Time Company, recently organized at Waterbury, is to be located at New Haven and will be in charge of C. D. Warner, now of Ansonia.

—— A certificate of organization of the "Monroe County Light, Heat and Power Company," has been filed at Rochester. Capital stock, $10,000, divided into $100 shares.

—— Messrs. Strawbridge & Clothier, dry goods dealers of Philadelphia, have contracted with Mr. R. T. McDonald, of the Fort Wayne Jenney Company, for an arc light plant of 200 lamps.

—— The power for the little electric motor exhibited at the last meeting of the Electric Club was furnished by the Volta-Pavia battery of the Chemical Electric Light and Power Company. It was very effective.

—— The Jarvis Engineering Company, of Boston, have finished their contract of resetting the boilers removed from Goerck street, New York, to the new shops of the Edison Machine Works, Schenectady, N. Y.

—— The New York towns of Waverly, Athens, and Sayre, have united in forming a stock company for the purpose of lighting the three places with the Brush electric light. Both arc and incandescent light will be introduced.

—— There is quite an interest taken in the new series lamp of the Schuyler Electric Light Company, which was illustrated on the first page of our issue of March 5th. The test at Philadelphia before the National Electric Light Association proved most satisfactory and interesting.

—— The Frenyear and Razee Electric Company, manufacturers of electrical supplies, has located in Mansfield, and will begin operations in its new factory next Monday. If satisfactory arrangements can be made, the center of the town will be lighted by electricity.

—— The California Electric, Gaslight and Fuel Company has incorporated with a capital stock of $3,000,000. The objects of the company are to erect and maintain electric wires and machinery and sell electric light, to manufacture gas and sell it in San Francisco, Oakland, Los Angeles, Sacramento, San Jose, and Stockton.

—— Mr. F. W. Pope-Cox, of Tacoma, W. T., has been in the East recently purchasing electric light plants for his city, and for Seattle, in the same Territory. He will represent the American system on the Western coast, and as he is an active electric light work will undoubtedly do a good business for the enterprising American Company.

—— The proposition made by the Richmond-Schuyler Electric Lighting Company to the city for changing the contract hitherto existing, by which the lights were run according to the American Meter Company's schedule, to one by which the lights will be run all night, each and every night in the year, at a cost of forty cents per light per night, has been accepted.

—— On February 3 the contract between the city of Zanesville and the Western Electric Company for eighty-two additional lights was executed. This will give the city 108 electric lights, and the company agrees to have them in operation within the next forty-five days. The price per light is $60 per annum.

—— W. L. Libbey & Son, proprietors of the New England Glass Company, make the following claim for their new patented semi-obscured arc globe: "Figures will show that our semi-obscured globes absorb less light than any globe yet produced, and therefore must meet an existing demand, which requires a translucent globe with a minimum absorption of light. For inside lighting this process meets with great favor."

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING FEB. 22, 1887.

358,317 Telephone exchange system; George L. Wiley, Elizabeth, N. J., assignor to the Western Electric Mfg. Company, Chicago, Ill.

358,341 Electrical accumulator or storage battery; Chaimsonovitz P. Elieson, London, England, assignor to the Electric Locomotive and Power Company, Limited, same place.

358,343 Armature for electro-magnets; Charles A. Gaiser, Edwardsville, Ill.

358,346 Electric lighting system; James E. H. Gordon, 28 Collingham place, Kensington, county of Middlesex, England, assignor to the Gordon Electric Light Company of America, Limited, Philadelphia

358,350 Electro-magnetic thermoscope; Henry J. Haight, New York, N. Y.

358,360 Electrical mail indicator; Virgil A. Krepps, New York, N. Y.

358,379 Telegraphy; Robert G. Brown, Brooklyn, assignor to the Standard Multiplex Telegraph Company, New York, N. Y.

358,386 Electric battery; Francis B. Crocker and Charles G. Curtis, New York, N. Y., assignors to the C. and C. Electric Motor Company.

358,393 Fire telegraph; John H. Guest, Brooklyn, N. Y.

358,415 Induction coil; Marmaduke M. M. Slattery, Woburn, Mass., assignor to the Sun Electric Company, of Maine.

358,417 Electrical door opener; Lucius P. Summers, Ormond, Fla., assignor to P. & F. Corbin, New Britain, Ct.

358,464 Galvanic battery; J. B. Perreur-Lloyd, Paris, France.

358,492 Sealing in of wires for incandescent lamps; and 358,493, Regulator for induction coils; M. M. M. Slattery, Woburn, Mass., assignor to the Sun Electric Company, of Maine.

358,519 Electro-pneumatic interlocking apparatus; 358,520, Electric fluid pressure engine; and 358,521, Electrically-actuated fluid pressure motor; George Westinghouse, Jr., Pittsburgh, Pa.

358,572 Insulating tube for electric conductors C. L. Clarke, East Orange, N. J.

358,599 Incandescent electric lamp; and 358,600, incandescing electric lamp; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y.

358,609 Electric conduit. Robert L. Harris, Brooklyn, N. Y.

358,645 Electric station indicating apparatus; Willard L. Bundy, Auburn, N. Y.

358,655 Shoal water alarm; Louis Frik, Philadelphia, Pa.

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BUSINESS NOTICE.

"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court (7 Beekman St.,) New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 13 Park Row, New York, was appointed, to succeed N. S. Keith, of the patent agency of the *Electrical World* and Associate Editor. N. S. Keith is known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World's* Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend."
—*New York Observer.*

ASSIGNEE'S SALE.

The undersigned will offer at public sale, on the premises, Bridge street, Sharpsburg, Pa., on Tuesday, March 15th, at 2 o'clock P. M., the equipment and machinery of the Brilliant Carbon Co., Limited, consisting of 1 three-light McTighe dynamo and lamps; 1 grinding mill, 1 set iron rolls, 1 emery wheel and frame, 1 scraping machine, 1 three-plunger hydraulic pump, 1 two-plunger hydraulic pump, 1 fourteen-inch hydraulic press, upright, 1 large horizontal press and moulds, 9 carbon moulds, 6 plating vats, complete; 6 iron tumbling barrels, and such other tools and machinery in use in a first-class carbon works; also lot of carbons. Works equipped with natural gas, and 3 carbon furnaces. Good shipping facilities by three railroads. Open daily for inspection. Offers for the whole at private sale will be entertained until day of sale.

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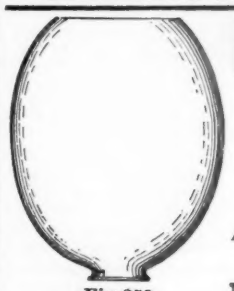
Fig.259

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Fig.255
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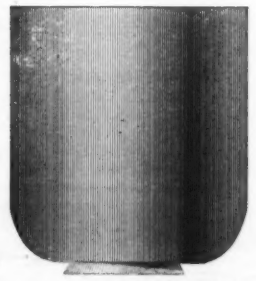
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